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CONTENTS

	PAGE
Life History of the Sea-Lions on the California Coast.....*John Rowley*	1
The Birth of Two Anthropoid Apes.....*Herbert Fox*	37
Experiences with Wood Rats, Neotoma fuscipes macrotis.....*Frank F. Gander*	52
The Moose and Red Deer in Norway.....*Sigvald Salvesen*	59
American Oligocene Rhinoceroses—A Postscript.....*Horace Elmer Wood, 2nd*	63
Description of a New Red Squirrel from North Carolina.....*Arthur H. Howell*	75
A New Souslik from Macedonia.....*V. and N. Martino*	76
General Notes	77

A Star-Nosed Mole's Nest at Newton Centre, Massachusetts, *Fred H. Kennard;* Microsorex hoyi in Captivity, *P. B. Saunders*; Cryptotis parva, a New Shrew for the Canadian List, *L. L. Snyder*; Midwinter Record of the Woodchuck in Western Pennsylvania, *Ernest G. Holt*; Thomomys bottae laticeps in Oregon, *Stanley G. Jewett*; Extra-Uterine Pregnancy in Peromyscus, *A. W. Moore*; Records for Phenacomys ungava in Ontario, *L. L. Snyder*; An Albino Field Mouse, *Edward R. Warren*; Occurrence of a True Fourth Molar in a Modern Horse, *Harold J. Cook*; Eagles' Prey, *George Bird Grinnell*; Mammal Notes from Randolph County, Georgia, *Francis Harper*; A Correction, *W. H. Burt.*

Recent Literature	85
Report of the J. A. Allen Memorial Committee	93
Comment and News	94

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JOURNAL OF MAMMALOGY

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LIFE HISTORY OF THE SEA-LIONS ON THE CALIFORNIA COAST

BY JOHN ROWLEY*

[*Plates 1–3*]

Although it was well known to earlier writers that two species of sea-lions were found commonly on the coast of California, namely, the Steller's sea-lion, *Eumetopias stelleri*[1] (Lesson), and the smaller California, or black, sea-lion, *Zalophus californianus* (Lesson), considerable confusion existed among some of them as to the species and distribution of the animals inhabiting this region and consequently their descriptions have not been entirely satisfactory nor trustworthy.

J. A. Allen, in his "Monograph of North American Pinnipeds," 1880, footnote, p. 296, says:

> Capt. Scammon published his first account of the sea-lions in the "Overland Monthly" Magazine (vol. VIII, pp. 266–272, March, 1872) in an article entitled "About Sea-Lions," which is substantially the same as that in his "Marine Mammalia," with the omission of figures and about two pages of tabulated measurements and other details, based on specimens subsequently obtained at the Farallon and Santa Barbara Islands. In a footnote in the "Marine Mammalia" (p. 125) he refers to his former article as follows: "Since the publication of the article "About Sea-Lions," in the "Overland Monthly," of September, 1871 (*lege* March, 1872!) we have had opportunity of making additional observations upon these animals at the Farallon Islands, where we saw the largest females we have

* Mr. Rowley died January 21, 1928.

[1] Replaced by the name *Eumetopias jubata* (Schreber), but for the purposes of this article the specific name *stelleri* will be used to avoid confusion in quotations from former authors.

different years from a large series of specimens. The total length measurement is the distance in a straight line from the end of the nose to the tip of the tail.

It does not seem probable that *Zalophus* should have been the species breeding in the vicinity of San Francisco at that time and that they should since have been replaced by *Eumetopias*, as it is the common habit of sea-lions to persist in breeding upon the rookery where they were born and reared, even in spite of continued molestation and persecution; and if the conditions where rendered impossible for the existence of one species on the Farallons or Seal Rocks off the "Cliff House," the same conditions would keep another species from taking possession. In other words, it is reasonable to assume that the species which originally resorted to any certain rookery would persist there, or else there would be none at all of any species; and therefore if *Eumetopias* is now found on the Farallons, which is an accepted fact, they have always been there and did not drive out former *Zalophus* inhabitants and usurp their breeding ground. Furthermore, the conditions at these two places were favorable to *Eumetopias* and not characteristic breeding grounds of *Zalophus* as found at the present day on the coast of California, as will be pointed out later.

Therefore, Doctor Allen was right in his surmise that the animals breeding in the neighborhood of San Francisco were *Eumetopias* and those found at the Santa Barbara Islands were chiefly *Zalophus;* and the skulls he mentions in the National Museum collections further prove these facts. As was well known to Doctor Allen, the gap in the upper posterior molar tooth-row in both sexes of *Eumetopias* is a constant determining character and alone serves to distinguish skulls of this species from *Zalophus*.

At various times during the past twenty-five years, the writer has had many opportunities for studying sea-lions on the California coast, in connection with the work of collecting specimens for museum purposes. As indicated in the title of the present paper, these observations are limited chiefly to this area, where the present breeding habits of the Steller's sea-lion are sometimes different from some of those farther north. On the California coast, this species now breeds only on small, rocky, off-shore islets, or isolated, exposed, surf-washed rocks that permit of access and are at the same time sufficiently elevated to furnish a place of safety during periods of high tides and storms; whereas, in more northerly regions, in some instances, as for example on the Pribilof Islands, they breed commonly, like the fur seals there, on rocky beaches of the mainland or large islands.

In response to an inquiry regarding the situation of sea-lion rookeries on the Oregon coast, Stanley G. Jewett, of Portland, states:

> This question has often arisen in my mind. To the best of my knowledge, there are no rocky outlying points on the Oregon coast on which the Steller's sea-lions resort to breed, with the exception of Yaquina Head on the coast of Lincoln County. That is the only spot on which I believe they actually come to the mainland. Otherwise, they are always on outlying rocks such as the Three Arch Rocks off the Tillamook coast, and those rocks known as the Rogue River Reef off Curry County.
>
> I have recently been in touch with R. E. Clanton who is very familiar with that colony of sea-lions. He states that there are now approximately 200 adult sea-lions at the rookery. Their number has been greatly reduced during the past few years through the efforts of bounty hunters who have killed a considerable number for the bounty offered by the fishermen.

Beach breeding, on the other hand, is the common habit of the California sea-lion and an isolated, surf-washed rock is not ordinarily chosen. At the present day, a sandy, rocky, or boulder-strewn beach is used, preferably one that is backed by high, precipitous cliffs which make the rookery inaccessible from the land side, just as in the present hauling place of the existing herd of elephant seals on Guadalupe Island.

California sea-lions also frequent long intricate caves which have been worn into the shores of rocky islands by the action of the sea, and although their pups[2] are also found in these places, it is not known definitely by the writer whether they actually breed there or whether the young are carried thither by the mother to try to escape from the persistent persecution of seal hunters. Such a condition exists on Santa Cruz, Santa Barbara, and Middle Coronado Islands, where for many years living specimens have been sought to supply the demand of zoological parks, circuses, and other animal shows throughout the world, the California sea-lion being the species commonly exhibited in these places.

In catching the animals alive in these underground waterways, the hunters adjust a net across the mouth of the cave and then proceed in their rowboat to the farther extremities of the cave chambers. By slapping the water with the oars, shouting, and flourishing torches, the

[2] Scientific writers have adopted the old sealers' terms for seals and sea-lions, and the males are spoken of as "bulls," the females as "cows," and the young are called "pups"—probably because of their resemblance to a puppy dog. The breeding ground of the "herd," or colony, is commonly spoken of as a "rookery," which is the ground selected upon which to bring forth the young, it being obvious that if born in the water the young would drown and sink.

hunters drive the frightened sea-lions toward the mouth of the cave. Sooner or later an individual in attempting to escape, becomes fouled in the net and is then easily transferred to a crate, and towed to the launch which is anchored in the offing.

When capturing California sea-lions on the beach, the hunters enclose the rookery on the water side by a long seine, which forms a semi-circle with the ends terminating at the beach on either side of the rookery. The bottom side of the large-mesh net is weighted and the upper margin fitted with cork floats placed a few feet apart. When set, the corks float a few inches above the surface of the water. The animals are then driven from the beach into the area enclosed by the net. One of the small boats manned by a couple of hunters enters the enclosure, and by beating the surface of the water with the oars, shouting, and firing off a revolver loaded with black powder, the men frighten the enclosed animals, which for some unaccountable reason seldom attempt to leap over the row of corks, but try to escape by diving, and one after another become fouled in the meshes of the net. When one is caught, a rope noose is thrown over its head, the end passed through a wooden crate open at one end, the animal forced inside, and a door dropped behind it. The crate is then turned loose and allowed to drift on the calm surface of the ocean until enough specimens are secured to fill the order, when the crates are picked up, towed to the launch, hoisted on board, and later shipped to their various destinations.

The present breeding range of the Steller's sea-lion on the North American coast extends from the neighborhood of the Pribilof Islands south to the Santa Barbara Islands; the most southerly rookeries, or breeding stations, being located on isolated rocks off the west end of San Miguel Island, and the southerly or westerly shore of Santa Rosa Island, these rookeries on the latter island being the extreme southern breeding limit of this species.

The breeding range of the California sea-lion is from the Santa Barbara Islands south along the coast of Lower California. At the point where their ranges meet, the two species come together and breed on Flea Island, off the northwest end of San Miguel Island, where a colony of about one hundred *Zalophus* is reported as being found on the south shore and one of about three hundred Steller's on the east side.

The writer is indebted to R. C. Ord, of Santa Barbara, who has spent the past thirty-five years on and about Santa Barbara Islands, for kindly furnishing much of the information concerning the location and size of the various rookeries in that vicinity, and these have been

recorded and indicated upon the accompanying map (Fig. 1) exactly in accordance with his personal observations. These in many instances have been verified by other authorities. Capt. A. Hyder of San Pedro, who has had many years' experience about the west coast islands, has also kindly indicated the location of some of these rookeries.[3]

The writer is also indebted to Paul Bonnot of the California Fish and Game Commission, who has recently been making a scientific survey of the sea-lions on the California coast, for furnishing data and verifying records of rookeries on the Santa Barbara Islands. He took advantage of the opportunity offered by the Fish and Game Commission launch to make a personal visit to these islands during the pupping season of this year (1927), with the object of procuring data as to the location of sea-lion rookeries and the approximate number of individuals inhabiting them, and was thus enabled to obtain the latest first-hand information regarding these points. He kindly placed at my disposal the following notes:

> I have verified the data which you gave me on May 28 of this year with the exception that I found no Steller's rookery at Johnson's Lee, Santa Rosa, as reported by Ord, but located one off the west end of this island. I also found a colony of about 60 *Zalophus* at Fraser Point, on the west end of Santa Cruz Island. My mention of the fact of finding both species breeding on the same rookeries on Flea Island, Offshore Rock, and Isthmus Rock does not mean that they are interbreeding but that the two species use the same rookeries. They sometimes have separate territory and are sometimes all mixed-up together, but I saw no incident which would lead me to think that they actually interbred.
>
> If you have not already heard, it might interest you to know that the rookery on Flea Island was practically wiped out, just after my survey, by a man from Oregon. We also picked up a hunter from Santa Barbara on San Miguel and convicted him of killing sea-lions in a closed district.

If this information be correct, the rookery reported by Bonnot off the westerly end of Santa Rosa replaces Ord's record of the occurrence in previous years of the one at Johnson's Lee on the southerly shore of the same island, and thus constitutes the most southerly breeding station of *Eumetopias* at the present date. Apparently the animals inhabiting

[3] It is difficult to procure accurate information at second hand as to the exact location of sea-lion rookeries, since an observer may on successive occasions note a band of the animals hauled out at a certain place and, without further investigation, convey the information that it was a breeding rookery. In compiling the accompanying map, this possibility has been taken into consideration and wherever there was doubt in the writer's mind, such reported rookeries have been eliminated.

these rookeries, from persecution or for other reasons, change their breeding stations from time to time; or possibly the resident animals are killed or driven off and replaced by individuals from other rookeries.

The southern limits of the range of the California sea-lion have not been definitely determined by the writer. Allen (Monograph of North American Pinnipeds, p. 289) says:

> The exact boundaries of the habitat of *Zalophus californianus* can not be given at present. Captain Scammon twice alludes incidentally to its presence "along the Mexican and California coasts," and Dr. Veatch states that "Sea-Lions" (which he calls *Otaria jubata*, but which are, almost beyond doubt, the present species) had populous breeding stations twenty years ago and doubtless have still, on Cerros or Cedros Island, in about the latitude of 28½°, off the Lower California coast. Whether they occur southward of this point at the present time I am unable to state, but should infer that such was the case from Scammon's allusion to their capture along the "Mexican" coast. In any case, it appears probable that in Dampier's time they ranged as far south as the Chamatly, and Tres Marias Islands, respectively in latitudes about 23° and 21°, at which points he saw "seals" in the year 1686. . . . .
>
> It is, of course, not certain that the seals alluded to are *Zalophus californianus*, since the sea elephant of the California coast also occurs at Cedros Island, and probably still farther south, the two species having apparently about the same range. If they had been the latter, Dampier would probably have made some allusion to their large size.

Dr. G. Dallas Hanna, of the California Academy of Sciences, San Francisco, who has given special attention to the marine mammals of the islands off Lower California, kindly furnishes the following information:

> The animals (*Zalophus*) are very abundant on Cedros, the San Benitos (Plate 1), Natividad, and Asuncion; a very small colony of not more than a score live on a shelf just above the wash on a little islet called "Outer Island" half a mile off the south end of Guadalupe Island. Todos Santos Islands have a rookery, but we did not stop. San Martin Island likewise has a rookery. On the peninsula, in 1925, Thurloe Head had twenty-five; Morro Hermoso, 250; Gull Rocks, just south of the latter point, 150; Cape San Lazaro, 100. These are rough estimates made from the deck of the ship, close in. The southern-most rookery of which I have knowledge is Cape San Lazaro, L. C.
>
> I did not hear of the species on the Tres Marias; we visited only Maria Madre and Maria Magdalena and did not see much of the west sides of them. It certainly does not exist on the Revillagigedos.

Dr. E. W. Nelson (Lower California and its Natural Resources, p. 134) says:

Sea-lions, and to a lesser extent harbor seals, have been killed on a small scale along both shores of the peninsula during the past and up to the present time (1921). In the Gulf of California they are hunted in small fishing boats, and on the islands of San Pedro Martir, Angel de la Guarda, and San Lorenzo. It is recorded that in 1884 hunters from Mulege killed 287 sea-lions. The hunting of these animals for their skins and oil is unorganized and sporadic. Their numbers are too small to warrant systematic exploitation.

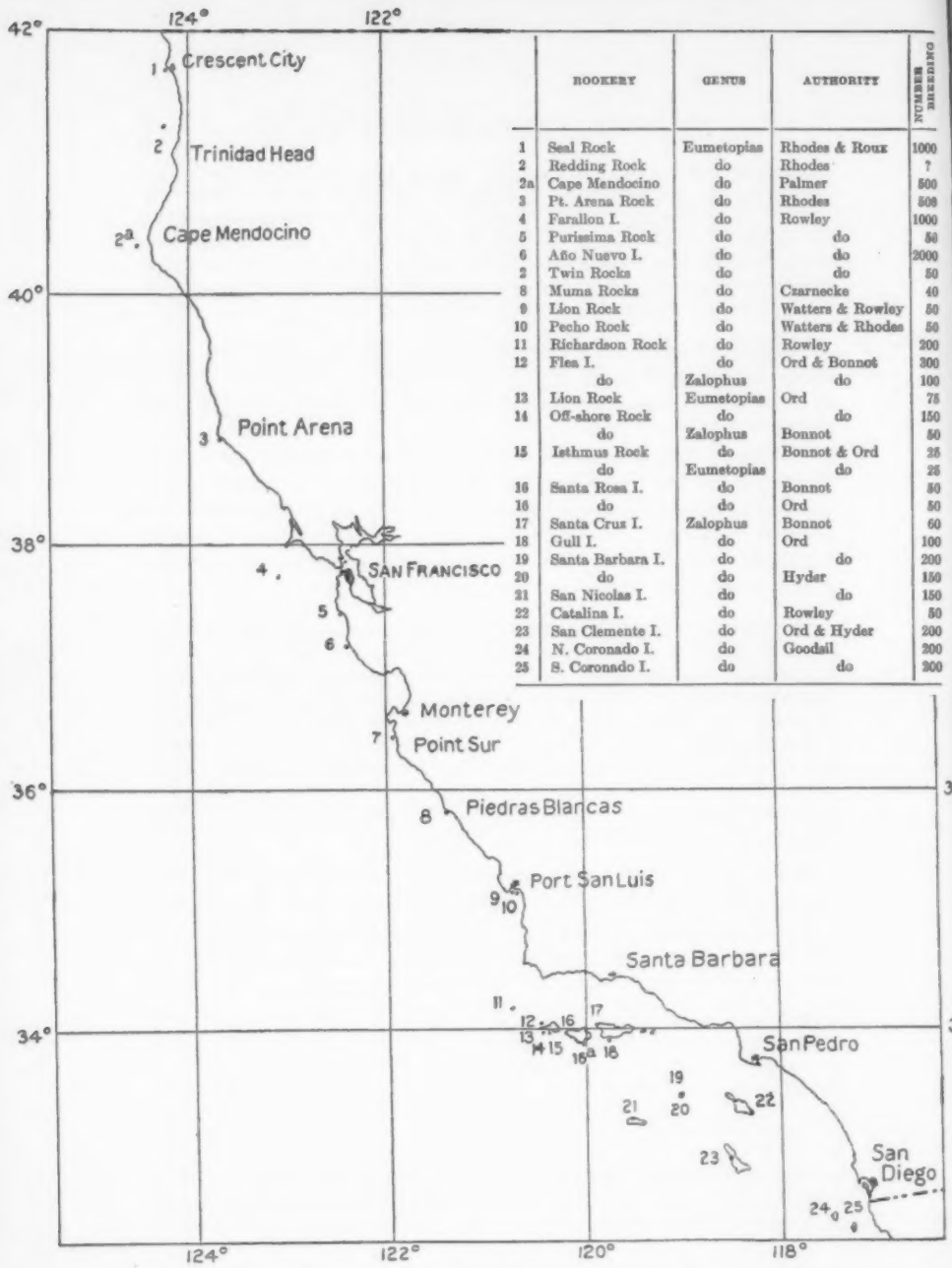
Sea-lions are also reported by other authorities as having been found on the islands in the Gulf of California, and it is not improbable that an investigation would reveal the presence of *Zalophus* breeding in these waters.[4]

Commander H. W. Rhodes, superintendent of lighthouses, U. S. Lighthouse Service, San Francisco, who in connection with his official duties of inspection and supervision of the lighthouses of the west coast has had exceptional opportunities for making observations on marine life, kindly furnished the following information regarding the distribution of Steller's sea-lions:

The chief rookeries along the coast of California are on the "Seal Rocks," about 12 miles off-shore westerly from Crescent City; at Redding Rock, about 6 miles off-shore and about 20 miles above Trinidad head; at the rocks about a half-mile off-shore and about one mile south of Point Arena; at the Farrallon Islands; at Año Nuevo Island; at Pecho Rock, a few miles north of San Luis Obispo light station; and at Richardson Rock, northwesterly from San Miguel Island. These constitute the principal rookeries of Steller's sea-lions on the coast of California, although there are a number of other places where they are found during the summer months in considerable numbers, and it may be that there are small rookeries at some of the other points.

At the suggestion of Commander Rhodes, who kindly furnished the names and addresses, keepers of various light stations on the northern California coast were appealed to for data regarding the location and approximate number of breeding individuals of sea-lion rookeries in their neighborhoods. These men universally responded and the writer

[4] In a letter dated September 17, 1927, to the author, Griffing Bancroft says: I have consulted with my son, who accompanied me on one trip; our recollections checked well, but we had made no notes. I found sea-lions abundant on Consag Rock, near San Felipe, in the northern part of the Gulf of California. . . . . I was on Consag March 7, 1926, and April 12, 1925. On the latter date there were perhaps two to three hundred lions on the border spit at the foot of the rock. There were a few adults males, but most of them were females, and there were many pups. . . . I do not remember seeing pups there in March, 1926. . . . . I believe there were about as many lions there in March as in April, certainly not any more.



	ROOKERY	GENUS	AUTHORITY	NUMBER BREEDING
1	Seal Rock	Eumetopias	Rhodes & Roux	1000
2	Redding Rock	do	Rhodes	?
2a	Cape Mendocino	do	Palmer	500
3	Pt. Arena Rock	do	Rhodes	500
4	Farallon I.	do	Rowley	1000
5	Purissima Rock	do	do	50
6	Año Nuevo I.	do	do	2000
7	Twin Rocks	do	do	50
8	Muma Rocks	do	Czarnecke	40
9	Lion Rock	do	Watters & Rowley	50
10	Pecho Rock	do	Watters & Rhodes	50
11	Richardson Rock	do	Rowley	200
12	Flea I.	do	Ord & Bonnot	300
	do	Zalophus	do	100
13	Lion Rock	Eumetopias	Ord	75
14	Off-shore Rock	do	do	150
	do	Zalophus	Bonnot	50
15	Isthmus Rock	do	Bonnot & Ord	25
	do	Eumetopias	do	25
16	Santa Rosa I.	do	Bonnot	50
16	do	do	Ord	50
17	Santa Cruz I.	Zalophus	Bonnot	60
18	Gull I.	do	Ord	100
19	Santa Barbara I.	do	do	200
20	do	do	Hyder	150
21	San Nicolas I.	do	do	150
22	Catalina I.	do	Rowley	50
23	San Clemente I.	do	Ord & Hyder	200
24	N. Coronado I.	do	Goodsil	200
25	S. Coronado I.	do	do	300

FIG. 1. PRESENT LOCATION OF SEA-LION ROOKERIES ON THE CALIFORNIA COAST

takes advantage of this opportunity to express his thanks to them and others who helped in giving information regarding the distribution of the sea-lions of this coast. The data thus secured from the various light keepers have been accepted by the writer as being thoroughly reliable and these men have been quoted as the authorities in defining certain rookeries designated on the accompanying map.

From data gained from this and other sources, in addition to the rookeries named by Commander Rhodes, the following breeding stations are listed: At Cape Mendocino; at Purissima Rock, near Half-moon Bay; one at the Twin Rocks about half-way between Carmel Bay and Point Sur; Muma Rocks near Piedras Blancas; Lion Rock about three miles north of Pecho Rock, Port San Luis; and those at the northerly Santa Barbara Islands, indicated on the accompanying map (fig. 1).

Regarding the Crescent City rookery (I on the accompanying map) Georges Roux, keeper of the St. George Reef light station, gives the following information:

> Animals at this breeding station are rapidly decreasing in number every year since the bounty on sea-lions has been in effect in the state of Oregon. Hunters come down every year from the Oregon coast and kill great numbers during June and July, transporting the scalps to Oregon and collecting the bounty fees. Passing close to the rookeries a few days ago, I remarked that the number of sea-lions had decreased very markedly. I also noted that the old breeding bulls had not come down in such great numbers this year as they had in former years, as they were being killed on their way down to the rookery from the north.

The rookery at Cape Mendocino is given on the authority of M. M. Palmer, the present keeper of the Cape Mendocino light station. In a recent letter from John W. Astom, who for many years has been keeper of the Point Sur Light Station, he states:

> Of late, there have been very few sea-lions on the Twin Rocks and I do not think they breed there any more. There is a rookery about one mile to the south of this station on an off-shore rock that a few years ago was full of sea-lions, but for the last two years there have been very few animals there and I do not know if any breed there at present. Of late years there have not been as many sea-lions in the vicinity of the station as there were ten years ago, possibly owing to the installation of our siren fog signal. [The fog siren in question probably had nothing to do with the disappearance of the sea-lions; as the Año Nuevo Island and the Farrallon rookeries are both close to the fog signals at these stations.]

Andrew Czarnecke, keeper of the Piedras Blancas light station, kindly supplied the following information regarding the sea-lion rookeries in that vicinity:

There are three rocks, one just abreast of the station, about 200 yards from shore, from which the station gets its name. No sea-lions breed on these rocks, but occasionally they will haul out and remain there for two or three weeks and are off again. These are not so large as the northern variety and are darker brown in color.

There are two other rocks about three-quarters of a mile south of the station and the same distance from the shore. On the smaller rock are found the large northern variety, to the number of about forty. I have seen young ones there, but no black ones. I could not give you the name of the two rocks. I looked on the chart but they are not named. Old settlers here call them the "Muma Rocks."

In former days, the Seal Rocks, off the Cliff House, near the entrance to the Golden Gate, San Francisco, and the sea-lions inhabiting which were probably some of the animals referred to by Elliott as "being found at San Francisco," were occupied by Steller's sea-lions as a breeding and hauling ground. Their close proximity to the mainland rendered them a great attraction to tourists and others, especially during the breeding season when the rocks were crowded with animals, which from shore resembled a great mass of gigantic maggots moving about. This spectacle was advertised far and wide as "one of the sights of San Francisco."

The accompanying photograph (Plate 2), made in 1889, is of historic interest as showing the great number of Steller's sea-lions which then resorted to these rocks to breed. By persistent shooting and persecution by commercial marine fishermen who claimed that the sea-lions were getting "the lion's share" of the fish in the vicinity, the animals, though under the protection of a county ordinance (which was not enforced) finally deserted the rocks, and although a few individuals occasionally haul out to rest and bask in the sunshine, they no longer breed there as formerly.

Between breeding seasons, individuals of the California sea-lion wander northward along the coast above their breeding grounds, and it has been reported on good authority that they have been seen as far north as the mouth of the Columbia River where they follow up the breeding salmon. Although careful inquiry has been made, I can find no *positive* record of a wild specimen of this species *actually taken* farther north than the neighborhood of the Santa Barbara Islands. Paul Bonnot, in a recent conversation, informed me that he had seen several *Zalophus* hauled out on the rocks at Piedras Blancas, above San Luis Obispo. He seemed positive of the identification of the animals, as he watched them from shore with glasses, and not only heard the distinct barking note characteristic of this species, but noted the high foreheads

of the adult males, which is a constant distinguishing character of the California sea-lion, as compared with bulls of *Eumetopias*. This is corroborated by Andrew Czarnecke (see *antea*) and also by George F. Watters, who has been keeper of the Port San Luis light station for many years. In a recent letter, the latter informs me: "We have often, in fact it is a very common sight, to see the black sea-lion in varying quantities at all seasons, passing and fishing directly off the station, although there are no rocks here on which they land."

On August 20 and 29, 1927, S. Morales and the writer visited Carmel Point (Point Lobos), and on both occasions observed a herd of *Zalophus* hauled out on Whaler's Rock, half a mile off-shore southwesterly from Carmel Point. Whaler's Rock is a saddle-shaped rock and the southerly prominence was occupied by about 40 Steller's sea-lions, among the number being one immature bull. The northerly end of the rock contained about 20 *Zalophus* consisting of four adult dark-colored bulls and the remainder being cows and young adults. The Steller's sea-lions were very quiet and spent most of the time sleeping, while the California sea-lion bulls kept up the incessant barking that is so characteristic of the species. With the powerful glasses with which we were equipped, the high foreheads of the adult male *Zalophus* and their dark coloration were easily distinguishable; and these characters, together with the unmistakable honking bark, proved beyond a doubt that the animals were *Zalophus*.

Prof. E. C. Starks informs me that he once saw a few sea-lions hauled out on an off-shore rock near Pacific Grove, possibly some ten miles farther north than Carmel Point, which he was almost positive were *Zalophus*. These observations would indicate that individuals of this species occasionally find their way northward to the vicinity of Monterey Bay, this being the most northerly limit of their range for which I have been able to procure reliable data.

The two largest and most important rookeries of Steller's sea-lions on this coast are situated one on the Farallons and the other on Año Nuevo Island. The latter is the larger and contains possibly two thousand individuals during the height of the breeding season, which is from about June 15 to July 15 in each year and occurs with great regularity irrespective of weather conditions. Owing to the fact that they are located upon United States lighthouse reservations, where they are now rigidly protected from shooting and molestation, these two stations have survived in full bearing as breeding grounds for Steller's sea-lions; and it is earnestly hoped that the protection thus far accorded

these sanctuaries will be continued for all time. It is predicted that unless further protective measures are adopted, it is only a question of time when every animal will have disappeared from the other rookeries that have been named, those that happen to be most accessible or that are located near growing centers of population being the first to go.

In early days, before petroleum products came into such general use as a substitute for animal fats and oils, the latter were almost entirely used for lubricating and other purposes, and that derived from whales and seals was sought from all quarters of the globe. The seals of the California coast naturally came in for their share of destruction to supply the demand. The elephant seal, once so common on this coast, was the first to go. Harbor, or leopard, seals were probably never very abundant here as compared with sea-lions, and the difficulty of securing them in any great numbers rendered this species of little commercial importance. Sea-lions, especially during the breeding season when their capture was simply a question of a calm sea which would enable the sealers to land upon the rookeries, where they congregated in great numbers, thus became one of the commercial assets in the production of animal oils, the hides and "trimmings" being also saved to make the business of sealing more profitable.

The lessened demand for seal oil and the reduction in numbers of the animals rendered seal hunting for oil unprofitable on the California coast and this industry ceased long ago. The demand for hides continued and the remnant of this industry was carried on commercially at the Santa Barbara Islands up to about 1909 and then came to a stop, owing to the passage of the law by the California State Legislature prohibiting the killing of seals or sea-lions in the Santa Barbara channel and the islands adjacent thereto. At that date, salted, half-dry "hair seal" hides were worth five cents per pound and were used chiefly as glue stock and to supply the demand for a cheap grade of leather. Luckily for the sea-lions, the skins of young pups, although possessing a fair pelage and for this reason having been commercialized to some extent, never were in great demand for furs or other economic uses. A number of years ago, a sample "raw" pup skin was sent by the writer to a representative fur house in New York to determine its value. The price quoted was so low, seventy-five cents, that it is no wonder that pup skins had not been active[illegible] commercialized heretofore.

The market for "trimmings" still exists and this demand has been one of the chief causes of the depletion of both species of sea-lions in recent years. The "trimmings" are taken from old bulls only and "a

set" consists of the genitalia, the lips with the whiskers attached, and the gall bladder. These are simply cut out of the animal, hung up and dried. A good set of trimmings containing long, perfect or unbroken whiskers readily brings five dollars. Owing to the fact that when dry a set of trimmings takes up comparatively little room, and in moderate quantities may be sent by parcel post or express instead of by freight as is usual in sending hides, they are thus easily concealed from a game warden in a closed district. Trimmings are eagerly sought by Chinese merchants and shipped to China where, I am informed, the genitalia are used in the manufacture of a "rejuvenating decoction" for the old mandarins, the whiskers for personal ornaments and for cleaning out their long-stemmed opium-pipes, and the gall-sacs for medicinal purposes.

The collection of a set of trimmings involves very little labor, once the bull is killed on land, and consists in simply cutting out the desired parts or organs, throwing them into a sack, and later hanging them out on a line to dry in the sun and wind, when they are ready for market. The bulls must be killed on the rocks, or towed there to enable the hunter to secure the trophies, as when the animal is swimming, even if it is killed outright by a rifle-ball in the brain and the hunter is fortunate enough to secure it before it sinks, the carcass is too unwieldy to handle in deep water from a small boat. If shot in the brain by a powerful rifle while in the water many seals or sea-lions will immediately sink like a stone. Others will float for periods reaching from a few seconds to several minutes, the time varying according to the volume of air contained in the lungs at the instant the brain is shattered. On rare occasions a seal will float for half an hour or even longer.

I remember once seeing a Steller's sea-lion cow which was shot with a .30–.30 bullet and which floated for an exceptionally long period. In company with S. Morales, of Monterey, California, an expert rifle shot and veteran seal-hunter, the writer was walking along the high rocky bluffs of Point Lobos on the southerly shore of Carmel Bay and saw the animal swimming in the ocean about fifty yards off shore. Upon being struck by a bullet, the sea-lion continued to float upon the surface. Wishing to secure the specimen, Morales ran to a small harbor, which was some five hundred yards distant, where he kept a small boat tied to a mooring. He rowed the boat around the point of rocks at the entrance to the harbor and then up the shore, the zig-zag course thus occupying at least half an hour. The animal still continued to float when he reached it. The total time consumed from the shooting

of the seal to the moment Morales made a line fast to the floating carcass was at least three-quarters of an hour. This was an unusual incident and surpasses all records for floating of a shot seal or sea-lion in all our experiences in seal hunting.

Adult Steller's bulls, at the beginning of the breeding season, are excessively fat and heavy. One rather under-sized specimen, which the writer weighed piecemeal at Año Nuevo Island by the use of large steelyards, totalled 1810 pounds. From this it may be estimated that some immense bulls of this species, when in first-class condition, would weigh at least a ton. When overboard and fast to a rope, a freshly killed adult bull will sink with a pull or strain on the rope of at least 100 pounds dead weight.

To handle so heavy an object in the water and try to carve out the trimmings is a task but seldom attempted. For this reason, the killing for trimmings is usually done on the rookeries, where the bulls of the larger species are found only during the breeding season. The presence of the hunters and the shooting frightens and agitates the entire herd. Many of the new-born pups are crushed by the big bulls or forced overboard in the scramble and excitement and when the killing continues at close intervals during the entire breeding season, as it usually does by professional seal hunters, the domestic activities of the animals are so upset that a protracted series of these persecutions extending over consecutive seasons is sufficient to drive the remaining animals from the rookery and break up the breeding station for all time to come.

In earlier days, the law prohibiting the killing of sea-lions on light-house reservations, like that designed to stop the taking of murres' or gulls' eggs for commercial purposes, was not always enforced on certain of these sanctuaries, and the Año Nuevo Island sea-lion colony suffered heavily during the breeding seasons of 1906 and 1907 from the killing of bulls for trimmings. During these years every available bull was killed, and had this poaching continued for a few more seasons it is doubtful if the Año Nuevo rookery would now be in existence. Before me is a letter from a former trimming hunter, dated July 26, 1906, a portion of which reads as follows: "I succeeded in getting 101 bulls and the crop [trimmings] is all sold and in our pockets. We have been towing out a lot of floaters [bloated carcasses] around the island [Año Nuevo] and today we sent 30 adrift to Santa Cruz and Del Monte to perfume the air for the bathing beauties."

Hunting the California sea-lion bulls was generally less dangerous than landing upon the surf-washed rookeries of the larger species, as

all that was required to make the former trip productive was a calm ocean which enabled the boatman to land upon the beach. The writer was informed by the late Capt. R. Vasquez, of Santa Barbara, a "professional" sealer who had for many years supplied the market of the world with living specimens for show purposes, that up to 1901 there were five distinct rookeries of black sea-lions on Santa Cruz Island, near Santa Barbara. Upon the occasion of my first visit to this island, in June, 1908, a rookery at Cochie Point on the north side was the sole survivor, and I was greatly surprised to find to what extent the wholesale slaughter of the bulls had been carried. I visited the rookery several times during a period of about three weeks, during the height of what should have been the breeding season, and during my entire stay saw but one adult bull, the remnant of the rookery consisting of about 100 cows and their pups, and perhaps half that number of yearlings and immature individuals. A short time after leaving the islands, I saw in the railroad freight-shed at Santa Barbara a pile of about two hundred salted, half-dry sea-lion hides billed to a San Francisco tannery. These represented but a single consignment from one outfit and were only a small portion of the number of animals slain, as many when shot were not killed outright and escaped into the sea to die of their wounds. The trimmings of all these animals had also been saved.

At the solicitation of the writer, with the coöperation of H. Bay Webster of Ventura, through the efforts of Senator Marshall Black of Palo Alto, and with the approval of the State Fish and Game Commission, the following year the California legislature wisely passed the bill protecting seals and sea-lions on the Santa Barbara Islands and the adjacent waters. This act is still enforced. In July, 1911, I again visited the Cochie Point rookery and found about the same number of cows and younger individuals as in 1908, with the addition of eight adult and several young adult bulls, showing that the protection afforded by the law was beginning to have its effect. But because of its accessibility and the comparative ease with which the animals could be captured alive for zoos and show purposes, this rookery has since been reported entirely wiped out. In capturing these animals, which is allowed in the closed district under a special permit issued by the State Fish and Game Commission, the hunters generally shoot any individuals that may become fouled in the net, such as old bulls that are too strong and unwieldy to handle, or specimens that may be undesirable to fill the order in hand, in order to get them out of the way. This unnecessary and wasteful killing has had much to do with the decrease in numbers of the

California sea-lions; and their capture for show or other purposes should be regulated so as to allow undesirable imprisoned animals to escape. Unless this be done, and unless existing rookeries from which animals are being taken are inspected and supervised so that only a certain number of individuals may be allowed each year in order that the rookery may not be depleted, one after another rookery will follow the former Santa Cruz Island rookeries to complete extinction.

On Catalina Island, the California sea-lion has been protected for many years by a Los Angeles County ordinance, which was passed many years ago at the request of the Banning Company, the former owners of the island. The Catalina beach rookery, situated on the shore about a mile from Avalon, has not been molested to any great extent for many years and some of the animals have grown quite tame and sociable, and are looked upon as an attraction to the many tourists visiting the island. The Catalina rookery is therefore a fairly protected sanctuary for the California sea-lion and as such will hold its own, and probably serve by its overflow to repopulate other less fortunate colonies of this species that are so remote from the protection of the law that poaching for trimmings will continue to keep down their male numbers. The word "probably" is used as above since data are lacking as to whether or not bulls of the California sea-lion go from one rookery to another in search of cows or are conducted there by the females, as is a common habit of the Steller's sea-lion at the beginning of the breeding season on the California coast. It is very likely that this habit is also shared by the smaller species.

Steller's cows and their pups, which continue to nurse almost to the date of birth of the succeeding pup, together with immature individuals of both sexes, remain on the California coast throughout the entire year, and it is a common sight at any season to see parties of from two to a dozen or more individuals swimming along off-shore or hauled out on a lone, surf-washed rock where they are beyond the reach of the breakers. Like the leopard seals, they must be either *in* the water or else entirely *out* of it. A compromise will not suffice. In all my experience, I never saw a leopard seal nor a sea-lion haul out to rest or sleep and remain with any portion of the body touching the water. They must be entirely beyond the reach of the waves. As the tide rises, if even the crest of one wave that is a little higher than preceding ones touches any portion of the animals, it makes them nervous and fidgety and they will keep "hitching" higher up on the rock until, when they can no longer conveniently find a spot where they are able to keep perfectly dry, they

will slip into the water and either go off to feed or to find a more suitable resting place where they can remain high and dry and continue their siesta.

When sea-lions are coming or going to or from the rookery, this habit also persists and the animals will habitually leap from the crest of an incoming wave and land high and dry on the rocks; and in leaving they will dive headforemost into the sea. They seem to have the power to estimate at a glance the depth of water into which they are about to plunge and vary the angle of the dive and that of the body accordingly, in shallow water making a horizontal flat dive and in deep water plunging straight down. They must also be able to discern submerged objects, as I have never known a single instance where a sea-lion injured itself by striking the bottom or a submerged rock or collided with another individual in the water, even when the animals were badly frightened and a great number hurriedly dove from a height and piled pell-mell into the ocean, seemingly one on top of the other.

H. W. Elliott ("Seal Islands of Alaska," p. 45), in writing about the swimming feats of the "bachelor" fur seals, says:

> The "halluschickee" are the champion swimmers of all the seal tribe; at least when in the water around the islands, they do nearly every fancy tumble and turn that can be executed. The grave old males and their matronly companions seldom indulge in any extravagant display, as do these youngsters, jumping out of the water like so many dolphins, describing beautiful elliptic curves sheer above its surface, rising three or even four feet from the sea, with the backs slightly arched, the fore flippers folded tightly against the sides, and the hinder ones extended and pressed together straight out behind, plumping in head first, to reappear in the same manner, after an interval of a few seconds of submarine swimming, like the flight of a bird, on their course. Sea-lions and hair seals never jump in this manner.

Elliott takes Doctor Allen to task at page 163, note 39, where he says:

> As I never detected the sea-lion or the hair seals leaping from the water around the [Alaska Seal] islands in those peculiar dolphin-like jumps which I have hitherto described, I made a note of it early during my first season of observation for corroboration in the next. It is so: neither the sea-lion nor the hair seal here ever leaped from the ocean in this agile and singular fashion heretofore described.
>
> Allen, so conservative usually, seems, however, to have fallen into an error by reading the notes of Mr. J. H. Blake, descriptive of the sea-lions of the Galapagos Islands. As Allen quotes them entire in a foot note (History of N. A. Pinnipeds, p. 211), I am warranted in calling attention to the fact that no authentic record has as yet been made of such peculiar swimming by Phocidae, or the sea-lion

branch of the Otariidae. My notice has been called to this mistake by Professor Allen's own note, p. 367, upon a quotation from my work, citing Mr. Blake's notes above referred to, which are themselves very interesting, but do not even hint at a dolphin jump.

It is a dangerous thing for any writer to make the sweeping statement that any certain animal or group of animals does not do this or that; or to make observations upon one species and then apply these to a whole group or family, as Elliott did, without confirming them by further investigation. In the matter of the swimming performances described by Elliott, according to my observations, he and Allen were both right. During the entire period of my observations upon seals and sea-lions, I must agree with Elliott in never having seen a leopard seal nor a Steller's sea-lion of any age make the "dolphin leap." It is, however, the common habit of *Zalophus* yearlings and immature individuals to thus form in line and disport themselves after the manner of the porpoise or dolphin, sometimes one leaping entirely over the back of another. The mood of the animals determines the speed with which they perform. When "full of pep," they will swim rapidly, with the body in its normal, upright position, the nose of one animal being but a few feet behind the tail of the preceding one, and thus the line hurries along as if it were real, serious business and part of the day's work, and may continue for half an hour or more. On the other hand, when they are in a calmer mood, and the surface of the water is still and "glassy," they will move slowly, sometimes lazily rolling over on their sides and allowing the upper front flippers to stick up in the air, as they slowly sink from sight into the sea.

Many of the facts that have been recorded about the life history of the fur seals by careful and competent observers are equally applicable to the sea-lions, and it would be simple duplication to again record these facts in the present paper. It is the idea of the writer simply to supply as a matter of record any observations made by him that may tend to straighten out certain former statements that may perhaps be still in doubt, also to give the results of his observations in contradistinction to those of other authors with which he may not be in accord. As an example of the latter, Elliott (p. 84) in writing of the white surface surrounding the eyeball of the Steller's sea-lion and which gives the animal such a "ferocious appearance," describes it as the sclerotic coat. As a matter of fact, this white area is a whitish ring around the outer edge of the iris itself, which is elsewhere dark brown, and this ring is in turn bounded exteriorly by the usual whitish sclerotic coat, which, as in

most animals, is kept covered by the eyelids to protect it, except when the eyeball is rolled in its socket or when the lids open beyond their normal limit. The Steller's sea-lion thus exhibits the whitish area which when the eye is open gives it a "ferocious" or staring appearance, even though the lids may not be opened to their full extent.

Steller's account of Steller's sea-lion, written about 1742, pictures a

> . . . . savage, terrible beast which when cornered and all chance for flight is shut off, turns upon his enemy with a great roar, shakes his head in wrath, rages, cries out, and puts the bravest man to flight. On this account this animal is never hunted at sea by the Kamchatkan tribes, because he overturns the boat of the hunters and slays them most savagely. . . . . All who have the skill and daring to hunt this beast, and who have killed many, are held in great honor by their fellows, and are regarded as heroes and braves. . . . . At eventide the mothers with the young go out into the sea and swim quietly near the shore. When the pups get tired of swimming they are wont to perch upon the backs of their mothers and rest. But the mother rolls over like a wheel and shakes the lazy pups off, and accustoms them to swimming. As an experiment I have thrown young sea bears and equally young sea-lions into the water, but they were so far from being able to swim or to use their flippers well that they beat the waves irregularly with their flippers and hurried to the shore. . . . . As to the food of these beasts, they prey upon fish and seal especially, and also upon otter and other sea animals. The old ones eat little or nothing at all in June and July, but take their ease and sleep, and at the same time become very thin.

Without attempting to discredit Steller's account of this "savage, terrible beast" and accepting it for what it may have been worth at that time, the fact remains that the Steller's sea-lion of the present day is a very different animal so far as these traits are concerned. On the California coast, except in the vicinity of the rookery during the breeding season, this sea-lion is usually a shy, wary animal, and it is almost useless for a hunter to try to approach, by rowing or sailing, close enough to one that is hauled out on a rock for a reasonably sure rifle shot. When swimming in the ocean, occasionally one will approach to within rifle range. But as a rule, a head will appear for a moment, the animal will stretch up its neck, take a good look at the boat, and sink beneath the ocean and disappear. These mammals have a wholesome respect for a boat of any description and even when near the rookery will keep at a distance from it.

During the excitement attending the breeding season when the newborn pups litter the rocks, the animals lose much of this timidity and will stick closer to the rookery in times of danger. The cows naturally wish to stand by and protect their young from possible enemies, and the

presence of some zealous cows that will not desert their young emboldens a few of the bulls, particularly immature individuals, also to hold their ground upon the rookery. Shooting at the colony from a near-by boat creates a tremendous roaring and bawling and most of the animals will dive overboard if the shooting continues. A person's landing upon the rock from a boat, in plain sight of the herd, will at once cause an uproar and stampede and most of the adult animals will at once desert their young and plunge into the ocean, where they gather in gangs at a safe distance and keep up an incessant roaring until the intruder retires. When the person continues upon the rookery, occasionally a few particularly solicitous cows, endowed with a superabundance of mother love, will select their own from the mass of sleeping or bawling pups and carry them by the skin of the back, or by the back of the neck like a cat carries her kittens, dive overboard, and transport the pups to a safer retreat. Sometimes they will make a stand at the edge of the rookery and since the new-born pups are unable to swim, the mother will deposit her young by her side and bravely defy the intruder, glaring savagely when closely approached and meanwhile facing the enemy and keeping up a steady roaring.

Adult bulls are too wary for this, and will rarely remain on the rookery after a general stampede caused by the presence of a human being and one or more rifle shots, and once overboard they will not return until the intruder hides for a very long time or is seen to leave the rookery. A gallant immature bull will sometimes remain and make a stand, either alone or with a small band of cows, and try to bluff an intruder who ventures too near; and in some instances he will make several lunges toward the enemy when the latter approaches too close and at the same time opening its mouth, and snarling and roaring. When the intruder runs away, the bull stops, glares, and retains his position, or goes back to his former stand, seemingly satisfied that he has won his point. Bluffing an intruder away seems to be the intention and not actually to seize his enemy. When again approached too closely, say within twenty five feet, the bull will repeat the attack, making a few forward jumps and stopping as before when the intruder retires. The immature individual shown in the accompanying photograph (Plate 3, upper figure) was one of these "bluffers," and, having learned the trick and feeling that he was master of the situation, he continued to "work it" for several successive days while the writer and assistants were collecting museum specimens upon the rookery. Before we left, this individual had grown so accustomed to our presence that he paid but little attention to us so long as we kept at a respectful distance from him.

"Bayed" cows, in defense of their pups, will sometimes attack in exactly the same way. When a stone is thrown at such a cow, no matter how violently nor how short the range, she will catch the stone with marvelous accuracy in her mouth, often at the expense of breaking off her teeth, bite it savagely, and toss it aside. A long stick or pole is treated in the same fashion, the animals violently wrenching it from the hand and tossing it into the air.

Such a thing as either a cow or a bull sea-lion making a persistent attack and actually chasing an intruder over the rookery for any length of time, as was recently published in a sensational article in the *Literary Digest*, as having happened to a much advertised motion-picture man, is contrary to the real facts, according to the observations of the writer and the testimony of many old sealers with whom he has spoken regarding this phase of the sea-lion's character and disposition. What would happen if one actually seized a person, an instance of which I have never known or heard of on the California coast, may be imagined from the account given by Elliott (p. 89) in which he speaks of a native who was seized by a bull sea-lion during a "drive" of these animals on the Pribilofs. The man was severely shaken and tossed, but was not bitten and mutilated. In fighting between themselves, sea-lions also seize, pull, and attempt to toss their adversary in this way and do not administer a series of crushing bites as is usual with the stronger-toothed carnivores.

Steller's account of the mothers teaching their pups to swim, while very pretty and interesting, is entirely at variance with the observations of the writer. Upon a few occasions, I have seen cows in the water accompanied by new-born pups, but only when they have been frightened from the rookery and were transporting the young to a place of safety. At such times the mother spent no more time in the water than was actually necessary, and although the pups on these occasions may be given a chance to rest upon the back of the parent, the baby was not taken into the water with the idea of giving it a swimming lesson.

While a new-born pup that is thrown into the ocean or gets washed overboard by a swell or finds itself afloat from other accidental causes will not drown at once, and can keep afloat for a long time by furiously beating the water with its flippers, still, so far as actual swimming is concerned, the animal is as helpless as a puppy dog in the water. The pups learn to swim by themselves, paddling first in the black filthy pools that form in depressions on the rookery, and which they also enter on warm days to cool off, and later by entering tide-pools and sheltered

coves on the shores of the breeding station. As they become more expert, they venture farther from home and later accompany their mothers on fishing excursions along the coast and elsewhere.

To what extent the young are fed upon fish that are caught by the parents during the nursing period the writer has no data. No doubt the pups early learn to fish for themselves, as several persons, one of the former light-keepers on Año Nuevo Island being among the number, informed me that when fishing off the rocks with hooks baited with chunks of fish or abalone they have often had their bait seized by young sea-lions that happened to be swimming along.

The diet of the sea-lion as vouched for by Steller is without doubt far from the truth. In all my experience, I have never seen a sea-lion or a leopard seal disturb or attempt to catch water-fowl of any kind. Gulls will habitually perch on the rocks or sit in the water within a few feet of sea-lions and neither will pay the slightest attention to the other. On the former Cochie Point sea-lion rookery, I have seen gulls' nests containing eggs and young built along the base of the cliffs at the rear of the rookery, and although not built on the ground where the pups could wallow on them, the nests were only a few feet up and easily accessible to the sea-lions had they chosen to molest them. The fact that the nests were there is sufficient evidence to prove that sea-lions do not ordinarily disturb them. As to sea-lions preying upon "seal especially and also upon otter and other sea animals," that is far from the truth.

Capt. C. F. Adams of Dexter, Maine, who has had over 40 years experience with sea-lions in captivity, training them for circuses and other animal shows, informed me that he once placed several captive California sea-lions in an enclosed tide-pool on the Maine coast and that they at once proceeded to eat sea-weed which was growing on the rocks, taking it probably for its medicinal effects just as a sick dog will sometimes eat green grass.

This leads up to the much discussed question of the food of sea-lions. It has been stated on good authority by one who had made actual observations upon the stomachs of a few slain sea-lions on the west coast that squid alone were found there and that these constituted the sole diet of the animals, no fish of other kinds being taken. Therefore sea-lions were not food-fish predators as was actually supposed and should be rigidly protected at all times.

In collecting specimens for museum purposes, the writer has taken advantage of the many opportunities offered to examine the stomach contents of slain individuals of seals and sea-lions. In these examina-

tions strange looking fish were sometimes found, some of which may have been possibly very rare or new to science, just as the remains of rare rodents are sometimes taken from the stomachs of hawks and owls.

In the opinion of the writer, these animals, like all others, work along the lines of least resistance, and take the food that is most accessible and at the same time most to their liking. A domestic cow will fill up on green clover in preference to dry hay, if they are equally accessible. But if the clover is beyond reach, she will eat the dry hay. It is just so with seals and sea-lions and, as a matter of fact, both commonly eat fish of any kind that are readily obtainable. During squid season, these, being found in abundance and probably easily secured, may form the chief food of these animals; but at this or other times of the year, fish of any kind that are not too large constitute the regular diet of seals and sea-lions. The bony heads of large fish, such as cod and salmon, are not ordinarily swallowed, it being the common habit of the sea-lion to bring the fish to the surface, bite through the vertebrae at the rear of the skull, and, by a quick and vigorous twist, snap off the head and send it flying through the air. The body, if not too large, is then swallowed whole, going down head first. It is very doubtful if sea-lions ever kill and attempt to eat a very large fish which would necessitate their eating it piecemeal or by biting out chunks, as is the common habit of other carnivores.

Sea-lions do much of their fishing at night, the warmer periods during the day being usually selected for sleeping and basking in the sun. There is no denying the fact that the numbers of fish annually consumed by seals and sea-lions are enormous. They are also a constant source of annoyance by damaging the nets of commercial fishermen and there is in consequence constant warfare between these men and the animal conservationists over the matter of destroying sea-lions.

It is, of course, impossible to secure accurate data upon the amount of fish consumed by a sea-lion in a natural state and whether such an animal requires more or less food than a captive specimen is unknown. It is very probable that healthy vigorous animals of this kind, having plenty of exercise and living under natural conditions where food is plentiful, eat generally more than one in captivity, especially cows which are nursing young most of the time. Regarding the amount of food consumed by captive sea-lions, Doctor H. C. Goodsil, director of research and education in the Zoological Hospital and Research Institute of the Zoological Society of San Diego, which society maintains living specimens of sea-lions in the zoological park there, in addition to giving

information regarding sea-lion rookeries on the Coronado Islands, kindly furnishes the following data: "We feed our sea-lions (*Zalophus*) between twelve and fifteen pounds of fish a day. This amount seems to keep them in good condition, though they will eat more. Of course, the amount varies with the size of the seal, but I refer now to the medium-sized ones. These run between eighty and one hundred and fifty pounds in weight. The weight of the adult females varies between one hundred and one hundred and fifty pounds, as nearly as I have been able to ascertain. An adult female that I autopsied, measured six feet over all and carried a fully developed foetus."

According to these figures, a big Steller's bull will weigh more than ten times as much as a California sea-lion cow; and working on the theory that the larger the animal the greater the amount of food required to maintain it, or that the grain consumed in a day by a horse might last a mouse a lifetime, a vigorous Steller's bull would therefore require upwards of one hundred and fifty pounds of fish every day to keep it in good physical condition.

From this, an idea may be obtained of the magnitude of the fish supply that is necessary to maintain a herd of sea-lions of the size of that on Año Nuevo Island, which may contain one thousand or more fishing individuals during the height of the breeding season. There is one factor in favor of sea-lions: so far as known, they usually kill only what is required for their immediate consumption and there is very little waste. In capturing fish that are small enough to be swallowed entire, every particle is eaten; while in the land predators, especially the larger cats, where game is abundant in many instances only a very small portion of a large animal killed is actually eaten by the original predator, the remainder going to waste or later being consumed by other predators or scavengers.

While there is no question that seals and sea-lions are more or less destructive to the food fish supply on the California coast—in all fairness and eliminating the matter of ultra-sentiment regarding the destruction of living creatures but at the same time admitting the viciousness of unnecessarily destroying any form of animal life which has not been proven actually detrimental—the fact remains that when the white man first appeared there were possibly a thousand sea-lions where there is one now and there were also ten thousand fish where there is one now. Which goes to prove that man is the exterminator, not the sea-lions. The latter are generally decreasing in numbers while the supply of certain food fish here is also annually becoming lessened.

As proof of the latter statement, an old seafaring friend of mine living in San Pedro, a man who has spent practically his whole life on this coast, making frequent trips with his boat to all the adjacent islands and who is an authority upon matters pertaining to marine products here, in a recent conversation informed me that he had been retained by a commercial fishermen's association of San Pedro to make a cruise to the neighborhood of Guadalupe Island, off the coast of Lower California, to take soundings and otherwise investigate conditions for deep sea fishing there. The idea was to locate a new and more promising fishing ground, as those in the waters adjacent to southern California had been practically exhausted and, if others could not be found, many of the fishing boats would be compelled to retire from business.

The waters about Cape San Lucas, the most southerly point of Lower California, teem with fish, many of them being edible and desirable for market. This field is being rapidly exploited by commercial fishermen and there is no doubt that here, as elsewhere, many tons of fish are taken annually that spoil owing to the distance from market, or reach an already glutted market and are thrown overboard rather than reduce the price. It is therefore reasonable to predict that, unless restrictions are enforced and the fishing privileges more strictly regulated, any new fishing grounds will in time also become exhausted. The gasoline launch is doing for marine life exactly what the automobile is doing in the extermination of terrestrial wild life throughout the civilized world.

These facts are introduced simply in evidence to support the contention that it would make no appreciable difference in the food fish supply if every seal and sea-lion on the coast were killed off. It is an established fact that certain kinds of marine animal-life which are incapable of artificial propagation are becoming scarcer just as are certain game birds and animals. Seals, whales, and other varieties of marine mammals which have commercial possibilities are not escaping gradual reduction.

In former days, the original animal population determined and retained the balance of supply and demand, and predators of all kinds, both marine and terrestrial, were limited and regulated according to these conditions. When man upsets this order of things, by killing off predators or their prey, new conditions are apt to arise and how far-reaching these may be can not be foreseen. For example, the theory might be advanced, that, so far as known, sea-lions may be responsible for the killing of certain fish which may be predatory on certain food fish and the fact that the latter are becoming scarcer in districts where

there are fewer sea-lions than formerly may account for the disappearance of certain food fish and not the activities of commercial fishermen as is generally supposed. The scarcity or abundance during certain periods or years of certain kinds of fish are difficult problems to solve, as there are so many agencies that may effect the supply, such as water temperature due to a change in ocean currents, breeding of the fish, and the destruction of their spawn.

Twenty-five years ago, the sardine was excessively abundant in Monterey Bay. It was an every-day occurrence to see boys and others gathered on the steamship wharf there fishing for sardines. All that was required was a short pole, a piece of strong line, and a gang hook—three fish-hooks fastened together back to back. As the immense condensed schools of sardines swam along a foot or so beneath the surface under the pier, the hooks were lowered, between the fish and, by jerking the line up quickly, a fisherman could impale one or more fish and throw them up on the pier. Ordinarily, it required but a short time for an expert to fill a small market basket, the fish were so abundant. Upon occasions, the whole bay would seem to be alive with sardines and these, together with allied small species of fish, were the attraction for hosts of pelicans, shags, gulls, grebes, and other water-fowl which spent the winter months in Monterey Bay.

When some man discovered the fact that these great schools of sardines had commercial possibilities and soon thereafter sardine canneries made their appearance, it sounded the death knell not only of the immense schools of sardines that had frequented the shores of the bay but also of the great mass of bird and other life that was dependent upon them. Today, the company steamers, fitted with up-to-date paraphernalia for capturing ton after ton of the great schools of sardines must go farther out to sea in search of material to keep the plant in operation. It is safe to say that one could carry in his vest pocket all the sardines one might now catch from the pier with a gang hook in a month's time. The immense swarms of birds which had become accustomed to wintering there because of the abundance of food have also disappeared and are today found in but small numbers as compared to the hosts of former years.

It is not to be inferred and it is not the writer's intention to convey the idea that the reduction in numbers of sardines in Monterey Bay was the only cause of the decrease in the winter water-bird life of that vicinity. Whatever they may be, other agencies which have caused a gradual decrease in the numbers of aquatic game birds in the state of

California and elsewhere, have had their effect on aquatic non-game bird life as well. Neither is it the writer's intention to convey the idea that the sardine supply as a whole is being depleted. For what the writer may know to the contrary, sardines farther out at sea or at other points on the west coast may be more plentiful than ever. The State Fish and Game Commission, through their scientific staff, has for a number of years been giving careful attention to the marine fisheries here and it is confidently expected that the matter of the depletion and threatened extinction of any species of fish, bird, or mammal will be quickly checked by the adoption and enforcement of congressional, legislative or other regulations that will effectually guard against such possibilities.

It occurred to the writer that the Monterey Bay situation offered a case exactly paralleling that of the sea-lion, on a smaller scale. Would it help to bring back the immense schools of sardines in their former abundance if the remaining water-birds were killed off? If it would, then my judgment would be to kill off the remaining sea-lions for the same reasons. If it would not, then leave both the birds and sea-lions alone.

In an article entitled "The Conservation of Predatory Mammals," published in the JOURNAL OF MAMMALOGY, May, 1925, Doctor Charles C. Adams, a recognized authority on the principles of conservation, remarked:

> One should not conclude this discussion of policies without reference to the menace of "political" interference and to various propaganda which so frequently obscures conservation measures. The predators have come in for their full share. Without question this is one of the most serious menaces to American wild life. This enemy to conservation may base their proceedings upon tradition or incomplete scientific knowledge. The matter of killing any predators should not be undertaken except upon the advice of scientific men who may have made a thorough study and investigation of the real facts; and upon their decisions should rest the problem of the reduction of numbers.

Adult bulls of both species of sea-lions on the California coast take no food of any kind during the activities of the breeding season, being sustained by their fat or blubber, and at the end of the period the tissues that secrete the oil have a loose flabby appearance, the cells having been robbed of their oil deposit. I have opened stomach after stomach of bulls of both species and invariably found nothing but a few fish bones, the ends of which were more or less worn from exposure to the stomach movements. These were sometimes accompanied by small stomach

worms and in many instances by a few round stones, some as large as a baseball. How these get there and what purpose they serve are questions which may be appended to the long list of Nature's mysteries.

Adult, or breeding, Steller's bulls are found on the California coast only during the breeding season. Bulls of the California sea-lion, on the other hand, are resident at all seasons. Since Steller's bulls are found only during the breeding season, June 1 to August 1, and since they take no food while here, it is obvious that they play no direct part in the destruction of fish on this portion of their range.

During the latter part of May, as the breeding, or pupping season approaches, Steller's cows will habitually band together, sometimes accompanied by immature bulls, in the neighborhood of the rookery, and form "rafts." They will thus sometimes spend hours, simply huddling together as closely as possible and making a compact mass, rising and falling with the swell, seemingly waiting for matters to develop. Bulls begin to arrive on the rookery during early June, coming singly or in bands of three to half a dozen, and by the middle of the month the breeding activities are in full swing. Within a few days after the pup is born the cow seeks the bull. Although certain bulls will take up certain positions upon the rookery and fight off other bulls to maintain their positions, and while certain cows may have a preference for particular bulls or specified locations, no such thing as an organized "harem," which is so distinctive of the breeding habits of the fur seal has ever been noted by the writer. Cows are free to go and come at all times and after she has had access to the bull, is chiefly concerned with the bringing up of her new-born pup.

In this connection, it may be well to give the observations of Prof. E. C. Starks of Stanford University, who has for many years made extensive studies of the food and other habits of sea-lions on this coast and is a recognized authority upon matters pertaining to them. In an article entitled "The Sea Lions of California," published in the AMERICAN MUSEUM JOURNAL (vol. 28, pp. 226–237, 1918), he says:

> I arrived at the rookery [Año Nuevo] on May 29 and found it in possession of a year-old pup, but I was told that a few days before a band of fifteen or twenty cows had "hauled out," to use a sealer's term, for a few hours; the next day, small bands of cows landed at different times, but no bulls appeared until evening, when a large one came and started a nucleus of a "harem" of three or four cows. By morning this had increased to eighteen cows. Two other bulls had arrived, but their time was so occupied in keeping out of the way of the first bull, who was a big battle-scared old veteran, and driving away bachelors, who persisted in landing on all sides, that they could do nothing towards forming harems.

The next morning (June 1) our old patriarch had a harem of twenty-three cows, and one of the other bulls had five. Six or eight more bulls arrived during the day, and by night there were two small harems besides the first large one. Our old friend, whom I dubbed Brigham Young, appeared satisfied with the number of his wives and remained quiet all day, except when another bull would come too close. Then he would make a fierce rush to do battle, but the intruder never accepted the challenge.

On June 2, the herd had increased to fifty, but by night had decreased to about what it was the day before. The next morning I counted eighty, but by night there were not more than thirty. Three times on two sucessive days entire bands stampeded into the water for some unknown reason, but soon returned to their original station.

From June 3 to 7 things went on about the same way, the herds increasing in the morning and decreasing in the afternoon. Hence I decided that the afternoon and night were the hunting and feeding times.

By the middle of the month the cows numbered about one hundred and fifty and were in charge of sixteen or eighteen old bulls. Nearly one hundred pups had been born. The harems were now not at all separated being in one large herd in which here and there a bull could be distinguished. Apparently each bull had marked out for himself a certain arbitrary area over which he was lord and master by right or might, and he never left his station except to offer battle to the lord of some adjacent realm.

Soon even this indication of harems was lost, for the bulls did not appear to confine themselves to any one area. No bachelors were allowed to land on the rookery, however. By the twentieth of the month virtually all of the pups had been born, about one hundred and fifty fat, sleepy little chaps. They were wholly without fear, and one could handle them and walk about among them if he was careful to avoid their puppy-like snaps, for their jaws were armed with very sharp little teeth.

The pups are also free to come and go as they please and seem to take life as a matter of course and do not worry. In the first days, their chief ambition in life seems a desire to be let alone so they can sleep. They usually band together, but whether for warmth or to develop their propensity for fighting and disturbing each other, I have never been able to determine. Just as one little chap has found a comfortable position and settles down for a quiet nap, another will start to wallow over him and the trouble commences. In searching for her pup, a cow simply wades into the bunch and noses about from one to the other until she locates her own, which soon begins to nurse. From my observations, I think it improbable that a cow will nurse a pup belonging to another cow, she looking upon all pups but her own as so much vermin. Lost pups invariably die by drowning or starvation, and I have on more than one occasion seen a pup attempt to nurse a cow which was not its mother and the cow simply reached down, picked up the pup and threw it ten feet in the air.

Sometimes when a rookery is upset by the presence of man and a solicitous cow hurriedly starts in to find her pup to carry it to safety, she will wade into a mass of pups, wallow over them totally regardless of their feelings, sending the little fellows sprawling in all directions, and will even seize and throw them hurtling through the air to right and left in her frenzied efforts to find her own. When this occurs many of the pups receive permanent injuries which later result in death, and an inspection of a sea-lion rookery, especially one which has been repeatedly disturbed, will reveal the presence of many dead and dying pups lying in all directions. Much of this mortality is also caused by their being crushed by adults, particularly bulls which in the excitement of the breeding season pay absolutely no attention to them and treat them literally as "so much dirt under their feet." On several occasions, I have seen a number of little pups huddle close to a sleeping bull, probably for the sake of warmth, and when the bull took occasion to change his position and roll over, the sleeping pups were crushed as flat as so many flounders.

Pups are of two prevailing colors, regardless of sex. Some are a reddish brown, and others slaty black, without any reddish tint. In looking over many pups to determine the proportion of sexes, it has been found that males predominate at least three to one over females. Yet in a normal rookery the proportion of adult females greatly outnumbers the male population. Nature has possibly taken care of the problem in this way, it being very probable that the mortality, due to fighting and other causes, is greater among males than females. Steller's yearlings of both sexes avoid the rookeries during the breeding period, probably owing to the unusual bustle and excitement that prevails; and in collecting a series of specimens for museum groups at various times, the taking of a yearling of either sex in the vicinity of the breeding station has always been considered rare good fortune. These may always be distinguished by their small size and uniform dark chestnut brown color.

My attention was first called to the fact that no adult Steller's bulls are found on this coast after about August 1, by the late L. L. Dyche, of Kansas University, who in August, 1902, visited the west coast with the object of collecting zoological material for the university museum. He procured a good series of Steller's cows and immature individuals, but saw no bulls. This information has been confirmed by observations extending over a period of many years. Immediately after the breeding season, the bulls leave the rookery, and without doubt they then proceed

up the coast and spend the winter in the waters of southern Alaska, possibly because of the abundance of fish there.

In a recent conversation George Willett, who spent a number of years on the coast of southern Alaska, informed me that:

> Sea-lions are common in southern Alaska waters throughout the year. Various breeding colonies are reported, mostly on isolated rocks, from the British Columbia boundary to the Aleutian Islands. The only ones of those that I have personally visited are on Forrester Island and at Cape Addington, Noyes Island, both in southeastern Alaska. From fifty to one hundred animals frequent the former colony and two to three hundred the latter. During the winter, sea-lions are widely dispersed along the coast and throughout the sheltered channels of the Alexander Archipelago. The most of the individuals seen at this season consists of females and immatures, I have seen bulls occasionally in the vicinity of Ketchikan. In localities frequented by the king salmon, such as Forrester Island, Noyes Island, and Cape Ommany, sea-lions are undoubtedly destructive. I have seen a dozen animals dive into a breaker and each one emerge with a salmon in its mouth. Besides destroying fish, they are destructive to fishing gear and for these reasons are cordially hated by the fishermen. The intestinal membrane of the sea-lion furnishes the waterproof clothing of the Eskimos and Aleuts. An entire suit of this material probably does not weigh more than a pound and may be carried in a pocket. The outer skin of the animal furnishes leather for "mukluks" and leggins.

As conclusive evidence of the migratory habit of Steller's sea-lion bulls, the following quotation from Capt. Scammon's "Marine Mammals of the Northwestern Coast of North America" (p. 125), may be cited:

> Doubts have been expressed as to the migratory habits of the sea-lion; but we are fully convinced that there are individuals, at least, among all the northern herds, that change from the cold latitudes to the tropics, as we have killed several of the animals upon the southern coast of California, during the month of June, in which were found arrow or spear heads, such as are used by the northern sea-coast natives. Professor Davidson states that in June, 1870, a spear head, such as is used by the natives of Alaska, was found in a large male sea-lion, taken at Point Arena, in latitude 39, on the coast of California.

In an article entitled "The Steller Sea-Lion Rookery on Año Nuevo Island, California, in 1924" (Barton W. Evermann and G. Dallas Hanna, Journ. Mammalogy, vol. 6, no. 2, p. 99, May, 1925) the following statement occurs:

> As to making commercial use of surplus males of Año Nuevo herd and others on the western coast, we believe that herein lies a possibility for a certain amount of profitable activity. The species is polygamous so that approximately ten per cent of the males are in excess of breeding requirements, and this portion might well be exploited. It is expected that measures will be advocated in the next

session of the California legislature whereby the Fish and Game Commission of that state will be empowered to carry on the necessary preliminary experimental investigations to determine the commercial possibilities of the species.

The writer is unqualifiedly opposed to the commercializing of sea-lions of any kind on the California coast or elsewhere. Even admitting that the practice of killing off a certain percentage of bulls has been beneficial in the management of the fur seal herds on the Pribilofs, the advisability of applying the same methods to another species of animal living under totally different conditions is questionable. Because there happen to be populous rookeries at such protected points as the Farallons and Año Nuevo Island, it does not seem proper that mammals that are being exterminated elsewhere should be killed at these well populated points.

According to the statement of the preceding authors, in 1924 there were approximately 400 adult bulls on Año Nuevo Island, 10 per cent of which would mean 40 individuals. What are these worth for commercial purposes? It would not pay to rig up a kettle to "try out" and later market so small a quantity of oil as these animals would yield. The hides when in demand were worth five cents a pound, "cut down," dry salted and dried, and a dry hide may weigh 75 pounds, which means the latter may sell for $3.75. The set of trimmings is readily marketable for $5.00. This makes a total of $8.75 to be derived from each bull, and if the full quota of forty bulls were killed, these would yield, according to these figures, a gross total of $350.00. After the expenses of labor, materials, and transportation are deducted, what is left?

And think of what this would mean to the rookery as a whole! If the forty odd bulls could be spirited off by themselves and corralled without disturbing the rest of the animals, all well and good, provided it were necessary to kill off any excess bulls, the policy of doing which for many reasons is very questionable. But they are only found here during the active breeding season, and in order to secure the carcasses without great expense, they must be shot on the rookery. When killed thus, the breeding activities of the entire herd are upset, many of the pups are forced overboard never to return, and the whole thing results in simply reducing the numbers of sea-lions at the points disturbed. At Año Nuevo Island, a few bulls could be obtained on the smaller rock; adjoining the rookery without, perhaps, disturbing the main colony; but the bulls that haul out on these smaller rocks are chiefly immature individuals which are not sufficiently developed to match their strength against the rookery veterans, and after a few were killed, the others

would soon become too wise to haul out there. Whether or no it would be good policy to kill off maturing bulls, from the ranks of which the old patriarchs must come, is also an open question.

As to the growing scarcity of sea-lions in the northern portion of their range, the following quotations may be cited from "The Fur Seals and Other Life of the Pribilof Islands" (Osgood, Preble, and Parker, 1914):

> Where formerly there were many thousands of the huge creatures there are at present only a few hundred on both islands. Although the sea-lions are no longer of great economic importance to the inhabitants of the Pribilof Islands, it seems desirable to preserve the remnants of the herds now existing there. The species is not of general distribution in the North Pacific but is confined to certain restricted and widely separated localities. Of these the Pribilof Islands constitute one of the most northerly stations. In most other parts of its range, the animals are subjected to persecution and are being rapidly extirpated.
>
> On the Pribilof Islands—a government reservation—the sea-lion herds are protected from indiscriminate killing without special expense or trouble and an excellent opportunity is afforded to preserve for all time small herds of these highly interesting animals. The herds may be drawn upon from time to time to furnish scientific specimens to museums and a few may be killed for other special purposes, but they should not be exterminated.

The authors could not have stated the case better had they been writing about the herds of sea-lions on the lighthouse reservations on the California coast, and I am heartily in sympathy with every statement made by them and particularly the following: "The sea-lion herds are protected from indiscriminate killing without special expense or trouble and an excellent opportunity is afforded to preserve for all time small herds of these highly interesting animals."

As already stated, the law prohibiting hunting on United States lighthouse reservations was accidentally responsible for the preservation of both the Farallon and the Año Nuevo Island sea-lion rookeries; and since the land is government property and light-keepers are stationed at both these points and could act as game wardens without extra expense, it would seem highly desirable that this matter be brought to the attention of the Bureau of Fisheries at Washington, with the idea of placing the breeding stations of at least these two islands under its jurisdiction and thus provide the additional protection which this department could afford.

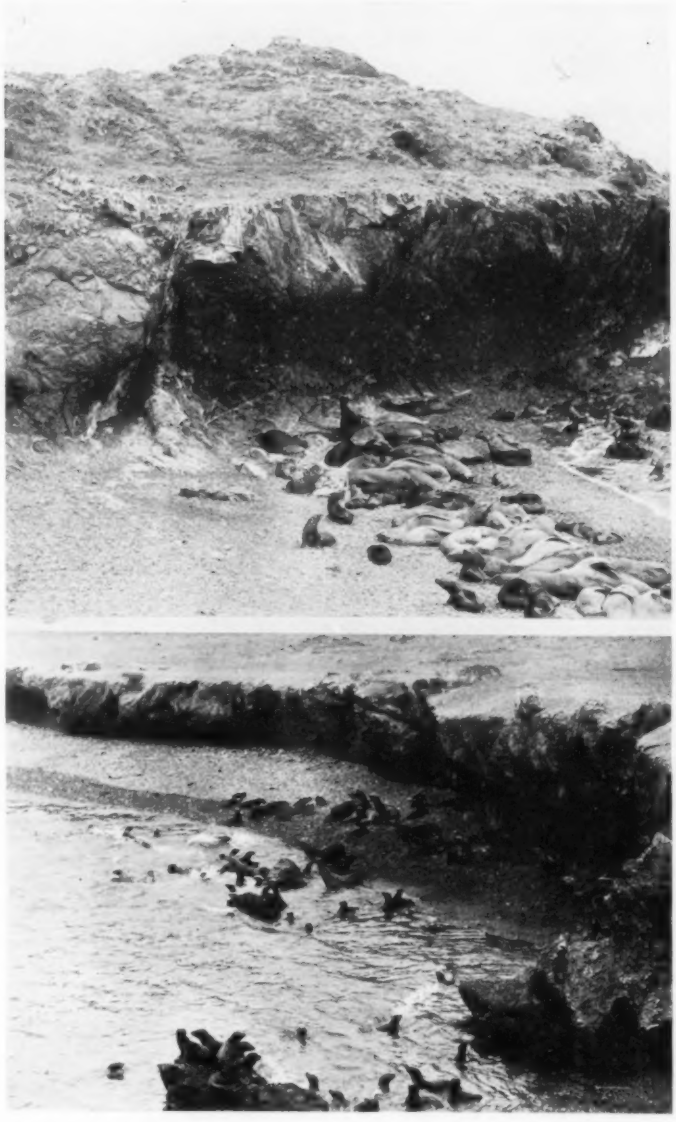
In both instances, these sea-lion rookeries are situated upon rocks that are detached from the main islands and no portion of them is used in any way to maintain the activities of the lighthouse service. A report filed annually by the head keepers of the light stations would keep the

Bureau fully informed as to the status of the herds and furnish data for their care and administration. Any other sea-lion rookeries along the west coast that are similarly situated with regard to lighthouse or other federal ownership might be included and the sanctuaries thus created would provide protection for the Steller's sea-lion and the overflow from these might perhaps help to build up and repopulate other rookeries that may have become decimated or extinct.

The Steller's sea-lion is at present, by reason of the two largest rookeries being under the protection of the United States Lighthouse Service, in pretty good condition as far as extinction is concerned in the near future. But the California sea-lion is doomed unless a similar arrangement can be effected with the owners of Catalina, Santa Cruz and others of the Santa Barbara Islands that are privately owned, and adequate protection be afforded them.

A certain amount of police duty, in addition to sign posting, would be necessary and this might be difficult to procure for the Santa Barbara Islands; but at Catalina Island the conditions are such that a sanctuary might easily be established. In a recent letter from J. H. Patrick, president of the Wilmington Transportation Company, which owns and controls Catalina Island, he states: "We are very much interested in preserving the sea-lions; they are one of the most relished sights by the tourists visiting the island. We run daily boats to the rookery at the eastern point of Catalina, and it is greatly to our interest from a financial standpoint to protect these animals. If you can devise any scheme that will assist in the protection of the sea-lions we would be very glad to coöperate."

Catalina Island therefore offers the most favorable opportunity for the establishment of a permanent sanctuary and unless some action be taken in the near future, which will afford more adequate protection than is now being rendered and where this interesting form of animal life can remain unmolested, it is only a question of a few years when the black sea-lion, following closely in the wake of the elephant seal, will also have become extinct on the California coast.



California Sea-Lions, East Benito Island, Lower California, August 13, 1922. Photographs by G. Dallas Hanna

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STELLER'S SEA-LIONS BREEDING ON SEAL ROCKS, OFF CLIFF HOUSE, SAN FRANCISCO, CALIFORNIA, AND SHOWING THEIR FORMER ABUNDANCE THERE. PHOTOGRAPHED BY TABOR, OF SAN FRANCISCO, IN JULY, 1889

STELLER'S SEA-LIONS AT AÑO NUEVO ISLAND, CALIFORNIA

Upper: An angry immature bull at close quarters. Occasionally during the breeding season a bull will defy a man. If approached too closely, the bull attacks by making several jumps toward the intruder, but stops if the latter beats a retreat. Such a thing as the continued pursuit of a fleeing man does not occur.

Lower: When hard-pressed by an intruder, a cow will sometimes seize her pup by the skin on the back of its neck and carry it to safety, like a cat carries its kitten.

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THE BIRTH OF TWO ANTHROPOID APES

By Herbert Fox, M.D.[1]

[*Plates 4–7*]

The very remarkable collection of primates, with the especially noteworthy group of anthropoids, at the Philadelphia Garden has been enriched during this autumn by the birth of a baby orang and a baby chimpanzee. The animals of the collection are unusual in the varieties exhibited and in the excellence of their condition, a state of affairs due to the wise provision of the directorial policy of the society, and to a devoted keeper. During the year 1928 there have been three orang-utans, five chimpanzees, a gorilla, three gibbons, and about eighty monkeys.

On September 25, the orang "Maggie" gave birth to a male baby, the first instance so far as we know of the breeding of these apes in captivity in America, while there have been only two cases in Europe.

On October 1, the chimpanzee "Marianne" also became a mother, another notable event, although such arrivals have been reported from the remarkable collection of Madame Abreu at Havana, and from the New York Zoölogical Garden.

The following pages contain an account of all the details that could be gathered concerning the mating, pregnancy, parturition and puerperium of these animals. The data are most nearly complete with respect to the chimpanzee, delivery having been observed completely by the writer.[2] The orang delivered herself in a position and at a time when observation was not possible. We had, of course, no knowledge of the time at which to look for it. A few notes are added at the end that were suggested by a reading of "Histoire d'une famille de chimpanzés" (Montané, Etude Physiologique, Paris, 1928).

The following is the history of the period of time covering the pregnancy, delivery and early suckling time of the orang-utan "Maggie."

[1] Pathologist to Laboratory of Comparative Pathology, Zoological Society of Philadelphia; Professor of Comparative Pathology and Director of William Pepper Laboratory, University of Pennsylvania.

[2] The writer wishes to record at this place that the account of these very remarkable and valuable observations is made as complete as it is by the interested coöperation and loyal helpfulness of the keeper, James McCrossen, and our laboratory secretary, Miss Bessie A. White. The writer wishes to acknowledge his appreciation of their assistance, in which he has no doubt the Zoological Society and the scientific world will join.

This splendid ape was secured from Ellis S. Joseph of New York City in the spring of 1926. She weighs about 130 pounds. Her mate, a huge beast of about 175 pounds came to the gardens in September, 1927, having also been purchased from Mr. Joseph. Both animals were captured in Sumatra, Dutch East Indies.

About the middle of February, 1928, "Maggie" suddenly developed a severe constipation for which there was no apparent cause. Simultaneously all appetite left her. She had had an attack resembling bronchitis or perhaps pneumonia around the first of the month. This lasted about a week, but there seemed to be a complete recovery. Just prior to the time the constipation and loss of appetite were noticed, she seemed as bright and active as usual. Such laxatives as are usually effective among the monkeys—milk of magnesia, castor oil, Carter's tea, prune juice—were offered, but because she was not eating and was drinking very little she could not be induced to take them. During the next three weeks she ate a little better, but frequently would go the entire day with no food at all, and drank little or no water. She would go as long as two weeks without any stool, but usually passed a small, dry, constipated piece of feces about the size of a nutmeg about once in ten days. During this time her activities and general demeanor remained unchanged, but the keeper believed her arms and legs showed some loss of flesh.

"Maggie" had shared her cage with "Chief," the big male orang, since October 6, 1927. Pregnancy was suspected, and because of this, and because the keeper advised against using force, no attempt was made to catch and restrain her for the purpose of giving an enema. The first observation that aroused the suspicion of pregnancy was swelling of the nipples and general mammary region during January, 1928. The nipples were frequently noticed to be enlarged and firmer, usually in the early morning. At times it seemed that the abdomen was enlarged, but the natural pot-bellied contour of the orang precluded any positive decision on this symptom. After the acute cold in early February there was a distinct ridge or shelf of the enlarged abdomen just below the ribs, such as might be expected in a squatting animal with an enlarged uterus. She was noticeably thinner by this time. About the middle of April the definite ridge-like shelf contour of the upper abdomen disappeared, suggesting the settling of an enlarged uterus into the pelvis. All during this period there was perceptible increase in the width of the abdomen. Enlargement of the breast areas was less from about the middle of April until June. Early in March some slight swelling in the vulvar region

was noted, and this remained stationary until during July, when it began to increase steadily. Enlargement of the mammary region was also much more conspicuous by this time.

Attempts to induce her to take some form of cathartic were persevered in. On March 4, she was offered five grains of blue mass in a prune. She refused it, but "Chief" promptly confiscated it; no effect was noticed in him. The death of an animal in one of the large separate cages made it possible to transfer "Maggie" to a cage by herself on April 4, 1928. On April 12, she was given one drop of croton oil in a grape, without effect. This was repeated April 14, with the same result. On April 16, three drops were given, still without effect. Milk of magnesia was tried frequently, and on May 10 she took two tablespoonfuls. This was repeated daily until on May 16, when the dose was doubled. By April 20, she was eating better, but much tact and coaxing had to be used. She accepted rhubarb stalks and bamboo branches, zealously hunting out the young shoots on the latter. Freshly pulled grass, especially young oats, seemed to be relished. These were in addition to the routine diet of lettuce and fruit. On May 9, she had one very small stool. No more were noticed until May 20, when there were two, the combined bulk, however, being less than one normal stool. Simultaneously with this, there was a marked improvement in her appetite. Whereas it was usually necessary to rout her out of the den to clean it, she was on this morning found sitting out on the roof of it, apparently waiting and eager for her breakfast. On May 24, the dose of milk of magnesia was reduced to two tablespoonfuls. Later smaller doses were tried, but were ineffective, and the daily dose of two tablespoonfuls was resumed. From May 25 on, the stools were normal in quantity and character and her appetite was very good.

During July "Maggie" began to show a gain of flesh all over, with a marked increase in the size of the abdomen, particularly well up toward the thoracic region, with a tendency to "pointing" in the midline just below the breasts. Her appetite was excellent, stools normal, and her general behavior all that could be desired in a normal, healthy orang. This continued through August and into September, but about the middle of September she became peevish and quite irritable.

When the keeper came on duty and made his first rounds on the morning of September 25, he found "Maggie" tenderly licking an apparently normal baby, still wet, and with cord and placenta still attached. Observations were limited as it was thought best not to risk disturbing her. During the day the little one was seen to move about in the

mother's arms, at times reaching up toward her face. "Maggie" remained lying down the entire day, cuddling her baby close to her face, but making no attempt to get it near her breast. At times, she evinced a mild curiosity toward the placenta, picking at it and turning it over, but making no attempt to separate it from the infant. She took her usual amount of fruit, but would not touch water or any other liquid, although she was accustomed to taking one quart of milk a day. The following morning the baby was noticed as apparently searching for something with its mouth, at one time sucking on the mother's ear. The mother by this time, 6:50 a.m., on the twenty-sixth, was beginning to show more interest in the placenta and cord, picking up the cord with her lips, then removing it from her mouth again. At 10:00 a.m., estimated as twenty-eight hours after the birth, she took hold of the cord with her teeth, close to the baby's abdomen, severed it, and then pushed the placenta over against the bars of the cage. Immediately she took up the baby and held it against her breast. It promptly found the nipple and proceeded to nurse. A few minutes later, "Maggie" emerged for the first time from the shelter to which she had retired for her accouchement, and with the baby clinging to her breast, climbed to the roof of the shelter and began a thorough examination of her offspring. A rather curious incident, and one worthy of note, occurred at this time. The keeper, taking advantage of her absence from the den, gave it a thorough cleaning and put in a fresh supply of bedding. "Maggie" had been accustomed to sleeping in the west end of the enclosure, and it was there that the baby was born; but when she saw the clean bedding forthcoming, she immediatly gathered it up, took it to the *east* end, made up her clean bed, to which she and the baby retired for a midday nap. Apparently "Maggie" appreciated the value of aseptic measures.

October 2, 1928. Since the last note "Maggie" has been doing very well. She is evidently a very good mother. The baby is not vigorous, but can and does climb all over the mother and nurses frequently. As early as the second day, the baby was able to cling to the mother's hair without the aid of the maternal arms. It is not practical to ascertain the amount of milk, but since the baby nurses and the nipples stand out straight, it is apparently adequate.

The baby has not been seen to void, but on the fifth day, the first stool was noted; it was firm and yellow. The mother did not have a stool for several days after delivery. On the evening of the fifth day, she drank a pint of warm milk to which four tablespoonfuls of milk of magnesia had been added. On the two succeeding days, three tablespoonfuls of milk

of magnesia were added to the usual pint of milk. Early on the eighth day, a moderate amount of feces was discharged in balls.

It was impossible to ascertain the lochia. On the fourth day, the mother left the den and bed mentioned above, and made a bed in the outer and larger exposed cage, where she has lain or sat with the baby a good deal of the time since. She was apparently not disturbed by visitors, either the garden personnel or strangers. Mr. McCrossen thinks her disposition is better since the delivery than before.

The placenta was roughly discoid, 17 cm. in diameter and a few mm. to 2.5 cm. thick. The cord obtained measured 60 cm. The whole mass was dried when obtained. It was soaked in water a short time and then fixed in formalin. There were some tears in the body of the placenta as if the animal had chewed at it, but there was no considerable defect as if she had eaten part of it.

The copulatory act of our orangs is worthy of description because of its dissimilarity from that described for the chimpanzee. When the desire animates the male and is reciprocated by the female, he pushes and mauls her a little, whereupon she lies upon her back on the floor. The male then approaches her and separates her legs. During the act he remains in a sitting or crouching attitude and though they are face to face, he does not lie upon the abdomen of the female. The male will sometimes grasp a leg of the female and hold it up and to the side during the conjugation. During the act, there is no fondling, nor do they mouth each other either before or after the act. The female lies passive and often has a hand over her face. The act is practiced daily, without relation to the sexual cycle. The period and interval of the sexual cycle has not been definitely established here. It is thought that the very slight bloody flow lasts 3 or 4 days. The frequency of copulation in the chimpanzee is greater. The act in the latter is similar to that described as having occurred in Havana, although there is no knocking on the floor with the backs of the hands. At no time has the keeper observed in either animal that copulation has occurred *more canum*.

The following is the account of the birth of a male chimpanzee to "Marianne" at 11:25 a.m., on October 1, 1928. This female is about seven and one-half years old and one of a pair that came here in the spring of 1924, when they were about three years old, and have been together uninterruptedly ever since. The origin of these two animals, according to J. L. Buck of Camden, New Jersey, who supplied them, is as follows: Both were captured by Mr. Buck, "Sultan" near Calahoon,

Sierra Leone, West Africa, about forty miles above Pendemboo, and "Marianne" in the vicinity of Porto Loco. These two places are about 90 miles apart.

"Marianne" was first seen to menstruate in 1926. She was always the larger of the two animals, although they were presumably about the same age. During the past year, menstrual periods have not been quite so regular, and at one time in the summer, her keeper, Mr. McCrossen, noticed a period of about seven weeks in which there was no menstruation, but it reappeared in August and September. The last period passed about the middle of September. Mr. McCrossen thought in the summer that there was a definite enlargement of the abdomen, but when seen by the writer, the latter could not be sure of this. There was no perceptible enlargement of the mammary glands. The animal's behavior has been about as usual.

On October 1, when the chimpanzee was first seen by the writer early in the forenoon, nothing was noted out of the usual. Breakfast was eaten. At about 9:00 a.m., the keeper heard a deep, sighing yawn repeated several times. (This, the writer surmises was the pain of the first stage of labor, which, if true, would indicate that labor began about 9:00 a.m. and finished at 11:25 a.m., two hours and twenty-five minutes.) About 10:00 a.m., McCrossen noted the usual chimpanzee howl, which, according to him, seemed to have what the observer would interpret as alarm and possibly pain. The vulvar region did not attract McCrossen's attention at that time. About 11:00 a.m., he observed that there was a definite prominence of the whole posterior region and very shortly the aperture of the vulva opened and something black was observed. The writer was called and saw the animal about 11:15 a.m., when it was evident that delivery was in progress. Consultation with Mr. Dill and Mr. McCrossen as to the wisdom of trying to get "Marianne" into the den inside, resulted in a decision that it was impossible to do this, and that we would have to make her as comfortable as possible in the outside cage. Her companion, "Sultan," was coaxed into the inside cage and the intervening door barred. When first seen, she was evidently in distress and confused. Her expression was blank or that of bewilderment. She moved around the cage, up on the box, up on the side bars and cross bars, all the while putting her hand on the presenting perineum and licking the drops of fluid that she could obtain. McCrossen reports that he saw no sudden gush of fluid. The drops that hung from the vulva were cloudy but quite limpid. The writer was apprehensive lest she drop the young from the top of the box or bars, and he had McCros-

sen put a large quantity of hay into the cage. She moved down into the hay and seemed quiet for a minute, when her mate, "Sultan," set up a racket, startling her. By reason of this, although perhaps coincidentally, the head popped out. It apparently came out with the sagittal suture in the midline, occiput posterior, but almost at once the face rotated to the left. While the top of the scalp was presenting, she plucked the hairs from it and ate them. After the head was delivered she continued plucking the hairs, and with her hand wiping off the moisture which she licked also. In one minute she began tugging at the head and putting her fingers into the mouth of the young to pull it. The cord was once completely around the neck. The eyes were shut and there was no attempt to breathe. Again suddenly the mate set up a scream, in which she joined and jumped to the top of the box with one leap. The body of the fetus was expelled with great rapidity and fell to the straw two feet below. She paused a few seconds, felt of her perineum, and then approached the baby and smelled, all the while licking her lips. The baby was not breathing, nor did it breathe for many seconds. She overlay it and put her mouth to its mouth. There was a distinct heaving respiration on the part of the mother, and it seemed to the writer, to Mr. Dill, and to Mr. McCrossen that she was blowing into the baby's mouth. The writer makes this statement with considerable reserve, and would not make it were it not that the act was repeated one minute later. Following the first probable artificial respiration, the baby breathed. This was perhaps one minute or one minute and a half after delivery. Then there were several seconds without respiration, when another heave was noted. Following the second "blowing" by the mother, respirations became more frequent and were perhaps ten seconds apart. During this minute or so, the mother overlay and cuddled the baby as it lay in the hay, mouthing it, licking it a little, investigating it and opening its mouth, and then later tried to open its eyes. After three or four minutes she left it and began to draw the straw up around her for a bed. A few seconds after she left it, the baby gave a wheeze and little cry, whereupon the mother rushed back to it, covered it, cuddled and mouthed it, and began what might be called kissing it. She then left it and returned to making a bed with the straw, in the midst of which she sat, ever and anon stretching out to cover, cuddle and investigate the baby.

When the baby was projected from the mother and fell to the straw the cord broke at about eight or ten inches from the body. There was, no hemorrhage from the fetal end of the cord, but there was a discharge

at that instant of perhaps a half ounce of blood from the vagina. As the mother leaned out from her bed to cover and cuddle the baby, she had a rather trembling respiration, sometimes heavy and sometimes very short and shallow.

The observations described required not over ten minutes, when the birth was complete, and the baby breathing regularly and rapidly with short abdominal respirations with some slight heaving of the chest. During a period of from about seven to twelve minutes, the placenta must have been discharged, although no one saw it pass. It was in the center of the bed when seen. The observer's attention was drawn to this fact by the mother searching around in the straw in the bottom of the bed and coming out with a bloody mouth. When left about fifteen or seventeen minutes after delivery, she was still mouthing the afterbirth, but there was no attempt to chew it.

Not the least interesting observation is the first expression of the mother. As above mentioned, it was that of bewilderment, then of anxiety or pain, and then, after the birth of the young and the beginning of breathing, the expression of bewilderment returned. She was evidently nervous, yet she seemed to know fairly well what to do with the infant. The writer would say that there was never anger or terror or true fear. Her fondling and caressing of the baby were quite as effective in making it comfortable and in cleaning it as would be possible for a human being. Mr. McCrossen, whose knowledge of these animals permits him to speak with authority, believes that she knew what she was doing and her actions certainly justified this conclusion.

The young was remarkably clean when expelled. The head, back and extensor surfaces of the extremities were well covered with black hair. The skin of the palms of all four feet was dull red. The remainder of the skin was a deep mottled brown. The mucosa of the lips, gums and tongue was a healthy pink. There were no teeth. The cry at first was a grunt, then a faint shriek, but the second and succeeding cries were more like the cry of a human infant.

During all this period, "Marianne" was apparently not concerned with the presence of Mr. Dill, Mr. McCrossen and the writer, or of a few visitors that were along the barrier about ten feet from the cage. Things happened so quickly that it was not practical to get rid of these visitors, but it is the opinion of Mr. McCrossen and of the writer that the presence of these people had no effect upon the behavior of the mother or the outcome of the delivery. The concern of the animal was more because of the unusual event that was happening to her than anything external, unless she was alarmed by the shriek of her mate.

During the fifteen or seventeen minutes observation after delivery, the baby was not lifted from the floor where it had fallen, and indeed she gave no intimation that she purposed to lift it to the mammary region. She pulled straw around it a little, but its bed was certainly not so comfortable as that she made and sat in.

At about 1:15 p.m., the placenta was lying a few inches from the baby's left foot as she overlay and cuddled it. Mr. McCrossen put the iron scraper, used for cleaning cages, in between the bars, and began scraping up bits of straw here and there near the front of the cage. Keeping up a continuous, gentle talking to the mother, he gradually manouvered the scraper nearer and nearer until he could reach the placenta and began to draw it away slowly. She made no attempt to keep possession of it, but when the scraper touched the afterbirth, she drew her lips back over teeth and whimpered softly until the scraper was withdrawn from the cage.

Very soon after the birth, "Marianne" voided urine, and continued doing so frequently all the afternoon, at first freely, then in small amounts; she immediately drank it.

At 2:00 p.m., she was offered a pint of warm milk which she drank eagerly. She took another pint at 5:00 p.m., and during the afternoon took her usual ration of fruit.

All during the afternoon whenever the baby cried, she would rush to it and cuddle and mouth it, but made no attempt to take it up. Toward evening as the air became quite chilly, her mate was boarded up in the den in the inside cage (to prevent his reaching through the bars) and the door between the inside and outside cages opened. Hearing the protestations of her incarcerated mate, "Marianne" hurried in to him, leaving her baby outside. She was immediately barred in, but tried to return. The den in the inner cage has two compartments so the vacant one was closed and the baby taken into it from the back and placed on a burlap bag. Even before this operation was finished, "Marianne" was shaking at the front bars of the den and trying to get into it. The instant she was admitted she resumed cuddling the baby, but still showed no signs of picking it up. The little body was very cold when picked up by the keeper at 5:15 p.m., and from 4:00 p.m. its cries were less frequent and were becoming weaker.

October 2, 1928. The baby passed the night in practically the same position as it was placed by Mr. McCrossen. It cried vigorously several times during the night. The mother continued to cuddle and overlay it, but up to this point had made no attempt to take it in her arms.

When visited at 9:00 a.m., on October 2, the baby lay on its back, now and then stretching and crying a little. The respirations were quiet, regular and shallow. The skin was clean and dry. The color of the hands and feet was reddish, and the color of the mouth and lips was deep pink. The eyes were open sometimes, and so far as could be seen were bright and healthy. At this time the prospects for life were good. The baby was noted two hours after birth and again on October 2 closing the fingers, sometimes with the thumb flexed over the second finger, sometimes over the third finger; when the latter occurred, the second finger was firmly flexed over the first finger.

During the afternoon of the first day, there was a little bloody lochia; on the morning of the second day, practically none. No changes in the breast, October 2.

October 3, 1928. In the last twenty-four hours the conditions have been as before. The mother is in good condition. She has made no attempt to lift the baby. This morning, Mr. McCrossen made three attempts to feed the baby with a bottle of warm milk and water, equal parts. When the nipple was placed in the baby's mouth, it made no sucking effort, but did swallow the drops of milk as they fell from the nipple, taking in all about three tablespoonfuls. In view of the fact that there has been no sucking reflex, it was decided to remove the baby from the mother and take it to the laboratory, keep it warm, and feed it according to the advice of Dr. J. C. Gittings, which is as follows:

Evaporated milk	1 part
Water	6 parts

Give one ounce or one and one-half ounces of the above mixture (or as much as he will take) every 2 hours. If he will not take the one and one-half ounce feeding, give one-half ounce every hour. Watch weight and general behavior. Give water occasionally. If he does well on this, after the first week, add 5 per cent lactose.

Mr. McCrossen expressed the opinion that "Marianne" would not be difficult to manage, and that she would probably settle down in a few days or so. There is no doubt that the baby is today less vigorous in its stretching and crying than at this time yesterday. It has made no voluntary motion to change its position. The course of events is best shown by transcribing the notes of Miss White, who assumed charge of the young animal during the nights following its removal from the mother. Mr. McCrossen cared for it during the day.

October 3, 1928. Baby chimpanzee received at laboratory 11:30 a.m. Atrophied cord still attached, measuring 49 cm. This was re-

moved. Dried meconium stool adhering to buttocks. Body surface cold. Wrapped in woolen cloth and placed out-of-doors in the sun from 11:30 a.m., to 1:00 p.m. Temperature taken at 1:00 p.m., but thermometer did not register. At 4:00 p.m., same result. External heat applied at 3:00 p.m. Weight 1720 grams. Length from crown to heel, 42.5 cm; crown to rump, 30 cm. Right ear, 50 x 35 cm. Fed at 2:00 p.m., five drams of the diluted milk. Regurgitated about half of it. At 4:00 p.m., three drams of diluted milk; at 6:00 p.m., four drams. A small amount of this last feeding was regurgitated immediately, and more about a half-hour later. During these feedings the baby made no attempt to suck, but swallowed involuntarily as the drops trickled back to its throat. At 4:00 p.m., it seemed much weaker than at 2:00 p.m., but by 6:00 p.m., appeared much brighter. The temperature at 5:30 p.m., was 97.6°F. and through the night and into the next morning, as follows: 8:00 p.m., 98.8°; 11:00 p.m., 99.6°; 3:00 a.m., 97.8°; 7:00 a.m., 97.8°. Two drams of hot water were given at 8:00 p.m.; this was not retained. Beginning at 9:00 p.m., and continuing through to 7:00 a.m., he was fed every two hours, one-half ounce at a time; all of this was retained. Between midnight and 7:00 a.m., he had three or four spells that seemed like paroxysms of pain. During one of these at 6:45 a.m., he voided urine During the next twenty-four hours, from 7:00 a.m., October 4, to 7:00 a.m., October 5, he took a total of five ounces of diluted milk, averaging one-half ounce to a feeding. He did not swallow so readily during the night, but when the 5:00 a.m. feeding was about completed, he suddenly began searching with his mouth as though for the breast. The rubber nipple was quickly placed in his mouth, and he immediately began to suck vigorously. This sucking reflex remained, steadily growing stronger.

Up to this point there had been no stool beyond the meconium referred to above. At 9:30 a.m., October 4, he was given two drams of olive oil by rectum. It was expelled immediately, and clear. At 11:00 a.m., he was given ten drops of milk of magnesia in his feeding. All during the day he seemed bright, more active and apparently stronger. He was able to kick himself free of the covers, and at 9:00 p.m., October 4, turned from his side over on his stomach. He seemed to be in pain at the time. He voided urine frequently during the night, but had no stool. At times he sucked his thumb or such part of his hand as he could get hold on. On October 5, the dose of milk of magnesia was repeated at 10:00 p.m. He was bright and active all day and took his nourishment well. At 7:00 p.m., he had a large, dark brown stool,

showing traces of meconium. All subsequent stools have been bright yellow, and the milk seems digested perfectly. By Monday, October 8, at the age of one week, he was taking from ten to twelve ounces of diluted milk in twenty-four hours, was bright and active, sleeping well at night, and seemingly well contented with life in general. His skin had turned darker after three or four days, although the fingers and toes are still of a purplish red color. His ears lie flat against his head. He sucked vigorously at his rubber nipple, his fingers, coverings, or anything within reach, frequently biting quite strongly with his gums. He could hold his head up with apparent ease, and had a strong grip in both hands and feet. When aroused by hunger or pain, he could pull himself half-way to a sitting position. He does not seem able to focus his vision, but is very sensitive to noises near him, and to touch. When a few hours short of a week old, he grasped the fore finger of the nurse with his right hand and held on with a firm grip while he was lifted clear out of the bed, and held there for one-half minute. His arm was flexed. He did not let go, but was lowered lest his grip weaken. His weight on this day, October 8, was 1650 grams.

The behavior and condition of "Marianne" after removal of the baby was as follows: Mr. McCrossen had no trouble in playing a trick that enabled him to secure the baby in safety to himself. As soon as the mother realized what had happened, her rage was directed chiefly at McCrossen, but also at helpers nearby. Her cries were those commonly used by an enraged chimpanzee. After about fifteen minutes she calmed down and soon resumed her usual activities, and, according to McCrossen, seemed to forget the event of the birth of the baby. At least she has not sought for it about the cage, has had no further outbreaks of temper, and she is friendly with her keepers. Shortly after removing the young one, arrangement was made that "Marianne" and "Sultan" could see each other, and on the following day, they were allowed to be together. During the succeeding day, conjugation was practiced. "Marianne's" disposition since the birth of the baby has been more friendly with her attendants, and she has been physically more quiet. She is now practically indifferent to the writer, for whom she has never had a high regard, as indicated on several occasions.

For some hours after delivery a few drops of blood-stained fluid came from the vagina, but thereafter observation was not satisfactory as she was in the straw a great deal. When seen twenty hours after delivery the writer noted that the tissues of the perineum had retracted, there was a litte pinkness around the vulvar opening, but the surfaces were

all dry. No increase in the size of the mammary region or the nipples could be observed. The nipples seemed to be larger than some months ago. No drops of milk were seen on them. Her appetite remained excellent, she did not miss a meal, and normal droppings began the day following delivery.

The placenta was very nodular or with small lobes. It measures 18 by 13 by 4 cm. The cord was attached one-third away from the edge.

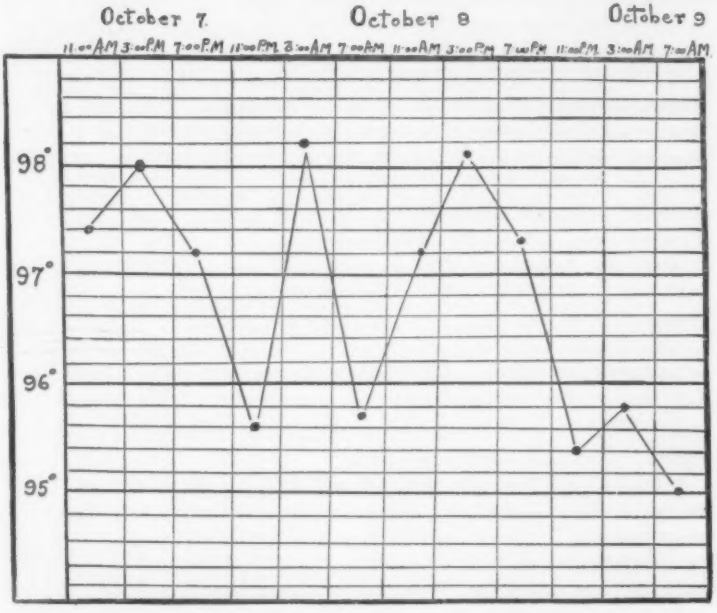


FIG. 1. TEMPERATURE CURVE OF THE BABY CHIMPANZEE

It had broken off near the placenta when the baby dropped. The part attached to the baby measured 49 cm.

The accompanying chart (fig. 1) shows the temperature curve of the baby chimpanzee from the seventh to the ninth day. Observations of the temperature were made because of the evident coldness of the young animal, and also for scientific record. It does not show the regularity of the adult animal, a natural and expected condition. At the time of writing, the baby is doing very well, strength is evidently

increasing, and he has a lusty shrill cry that often begins with a dull guttural note.

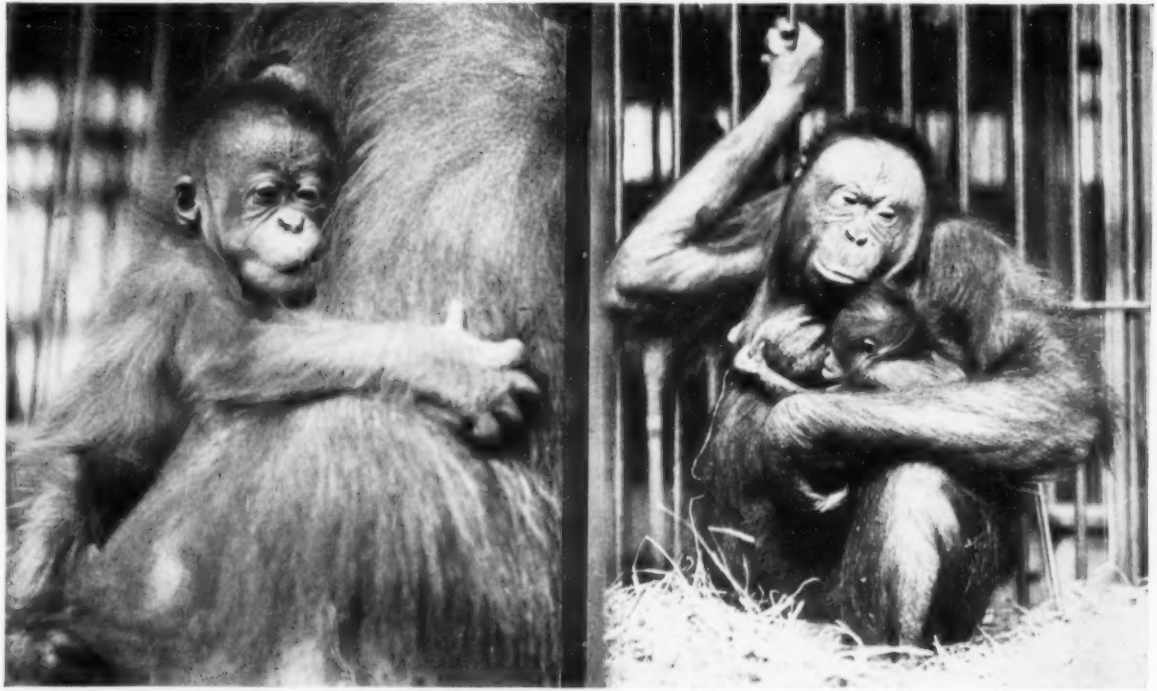
The following are the notes suggested by the reading of Dr. Louis Montané's notable publication, "Histoire d'une famille de chimpanzés (Paris, 1928):

It is mentioned in his article that the mother was apparently nauseated or lacked appetite during the pregnancy. No such observation could be made concerning "Marianne," her appetite being as usual throughout the gestation period.

The method of copulation was similar to that described for the original mating of "Jimmy" and "Cucusa" at Villa Palatino. Although the act was practiced frequently, day and night, during the interval between the heat periods it was more prolonged and apparently more interesting to both animals, the female especially, during these periods. "Heat periods" means the duration of the perineal swelling. The greater the swelling, the more frequent the sexual act.

After the delivery of "Cucusa," she was evidently exhausted. No exhaustion was noted in our "Marianne." She was, perhaps, quieter than before, but by no means depressed or exhausted. At the end of the second week in our animal, no true milk formation has been observed. "Cucusa" had milk from the second day. The Havana ape raised her baby from where it was found between the legs, to her breast very shortly after its birth. Our ape made no such attempt in the forty-eight hours the baby was left with her.

It is noted by Doctor Montané that sixteen days after delivery there was loss of blood without turgescence, and that "Cucusa" menstruated after eighteen months, and "Monona" after twenty-one months. Eleven days after delivery of our chimpanzee, there was a bloody fluid seen once, about midday. Thirteen days after delivery, there was definite swelling of the whole perineal region, as if the period were returning. The opening of the vulva was reddish, but no flow started. Swelling remained at the height for four days, but there was no true menstrual flow except the one day mentioned above, although the external appearance was that of normal menstruation. The swelling subsided at the usual rate. The return of menstruation was apparently due to absence of lactation, which in turn was probably due to failure of placentophagia. It is, however, noteworthy that the orang, which did not eat its placenta, had normal lactation.



LEFT FIG. BABY ORANG GRASPING THE MOTHER'S SIDE. EIGHTH DAY. RIGHT FIG. MOTHER AND BABY ORANG ON THE EIGHTH DAY IN A POSITION FREQUENTLY ASSUMED

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MOTHER AND BABY ORANG. SHOWS THE SPREAD-EAGLE GRASPING POSITION OF THE BABY AS THE MOTHER CLIMBS ABOUT THE CAGE

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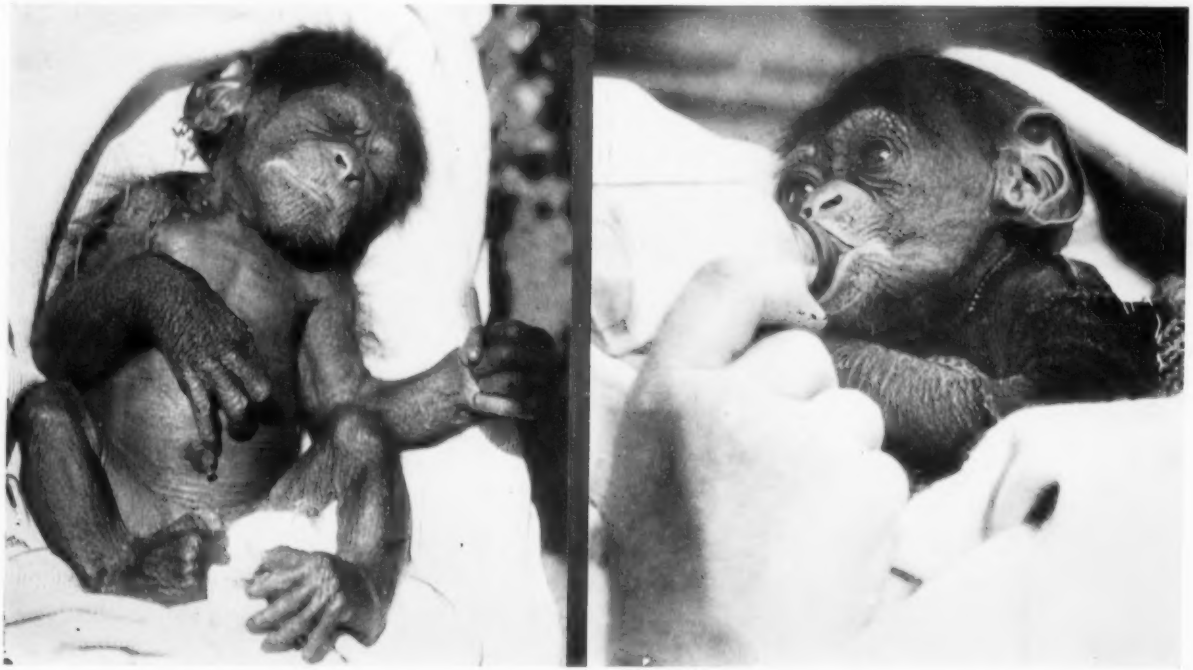
BABY CHIMPANZEE FORTY-EIGHT HOURS OLD, IN THE ATTITUDE OF STRETCHING, BUT NOT CRYING OR WHINING. IMMEDIATELY AFTER REMOVAL FROM THE MOTHER'S CAGE



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LEFT FIG. BABY CHIMPANZEE ASLEEP. SHOWS THE MAINTENANCE OF THE FACIAL FOLDS, THE ANATOMY OF THE EXTREMITIES, AND THE POSITION OF THE THUMB OVER THE FINGERS WHEN THE HAND IS CLASPED. RIGHT FIG. BABY CHIMPANZEE HAVING ARTIFICIAL FEEDING. NINTH DAY. SHOWS THE FACIAL FOLDS DURING THE SUCKING ACT, THE CONDITION OF THE EYES, AND THE STRUCTURE OF THE EAR

EXPERIENCES WITH WOOD RATS, NEOTOMA FUSCIPES MACROTIS

By Frank F. Gander

In the course of my work at the O'Rourke Zoological Institute in San Diego, California, during the past year and a half I have repeatedly been in contact with wood rats of the form *Neotoma fuscipes macrotis*, chiefly through my having participated in the examination of approximately one hundred of the huts or piles of sticks which they assemble for a home, but also through collecting and through keeping specimens in captivity. My experiences have been both varied and interesting and I have learned many things about these fascinating little mammals.

Instead of the more generally accepted name of wood rat for all rats of this genus, I shall employ the term "brush rat" here, since it is used locally and since this form is by no means restricted to woodlands, but is, if anything, more abundant in brushy areas than in wooded ones. It is true they are to be found in abundance in oak woods and even make their homes in hollow limbs or make over old birds' nests in the smaller branches, many feet from the ground. They also, not infrequently, build their homes in the crevices of rocks. But what seems to me their typical home is the conical hut of sticks which they construct in brushy areas, and it is with this type that my observations are chiefly concerned.

Such huts are to be found in large numbers in the brushy canyons of East San Diego and most of my work has been done there. A few huts have been opened in Mission Valley, just north of San Diego and also some at Monte Robles, near Ramona, California, at an elevation of about 1600 feet. Only two or three huts were opened before March 27, 1927, but since that date several have been examined monthly. The East San Diego location is within the city limits of San Diego, and is approximately the type locality of this form.

These huts are usually, but not always, built around the base of some shrub or bush, and many different species of plants are thus utilized. One of the favorites is the scrub oak (*Quercus agrifolia*), closely seconded by the laurel-leafed sumac (*Rhus laurina*). Many other species are used but these two plants harbor at least 50 per cent of the huts. Clumps of cactus (*Opuntia tuna*) are frequently utilized and such huts are practically impregnable.

The huts are usually more or less conical in shape but of various sizes. We frequently find them over six feet in height and with a base over six

feet in diameter. Such comparatively huge structures are usually many-storied and very ancient. If the hut is built about a scrub oak, the trunk is frequently entirely hidden from sight and the presence of the plant is known only by the limbs which protrude on all sides. If these limbs reach to a nearby shrub, one will find a doorway or opening at the point of their emergence from the hut and these are used by the rats as exits from the upper part of their huge home. Numerous other openings are to be found at the ground level, and paths lead from them through the brush, sometimes to another hut and sometimes they divide and subdivide until they are lost. Scattered about over the face of the structure, at various heights, one will find little porch-like openings, enclosed on three sides and on top and bottom, but open on one side to sunlight and fresh air. In the back of such a porch is the opening of a passageway which leads to the interior of the hut. Leaf stems and other waste from their food usually form a mat on the floor of these sun-porches.

Passageways run through all parts of the hut and frequently open out into large chambers in the central parts. The nests, which are neatly made of shredded grass and bark, are usually placed in small chambers near the outer part of the hut but without an exterior opening. Not infrequently there are three or four of these nests in one hut.

Another important part of the hut is the food chamber, which in structure is like the large empty chambers in the central part of the hut but is usually filled with stored food. This food is chiefly in the form of flower clusters and small leafy twigs nipped from the surrounding plants. A much greater quantity is stored than needed, so that the fresh material is resting upon partially dried, this in turn upon thoroughly dried, and that upon decomposed material. Leaves or flower clusters of the following plants have been found stored in the food chambers: *Rhus laurina, Rhus integrifolia, Rhus diversiloba, Prunus ilicifolia, Ceanothus verrucosus, Sambucus racemosa, Quercus agrifolia, Adenostoma fasciculatum, Lonicera interrupta, Eriogonum fasciculatum, Photinia arbutifolia, Eriodictyon crassifolium,* and a species of *Clematis.* One nightshade berry was found, and also fragments of acorn shells and broken seed hulls of wild cherry. Poison ivy was found in several huts and not infrequently grows there. No stored acorns or other seeds have been found.

Many huts have a special place for the deposition of feces, but others do not show this characteristic. Where such a point has been selected it is undoubtedly used by generation after generation, just as the huts are used. The age of some of these huts must be very great indeed, judging from the depth of the vegetable humus under them and the

decomposed condition of the sticks forming the base. In many cases tunnels penetrate this humus and are used by the rats as a refuge in time of danger. Huts on hillsides frequently have tunnels going deep into the earth and in such cases the rats are safe, at least from man. Many species of fungi are to be found growing in these underground tunnels and in one hut a beautiful orange-colored *corral* fungus was found in abundance.

I frequently take groups of boys on field trips for nature study and I have found one sure way of keeping their interest and making the trip enjoyable for them is by letting them assist me in the examination of these brush-rat huts. So on our trips, whenever we happen upon one of the huts that is not too difficult of access, we form ourselves in a circle around it and commence to pick it to pieces, working in from all sides at once. The situation is very tense as the rats always do the unexpected. Some rush out at the very beginning of operations, others hide until their last place of concealment has been opened up, and some dart out and back several times before they are captured or escape. Several of the boys have become very expert in catching them, and as the rats are surprisingly gentle it is very seldom that anyone is bitten. However, they kick and scratch viciously with their hind feet and must therefore be handled with caution. Many of the young rats squeal when captured, but the old ones as a rule are silent.

If the fleeing rat succeeds in getting past the circle of workers it is safe, as it is impossible to follow it in the thick brush. The rats usually disappear in rapid flight along some one of the many little trails that lead off from the hut. Occasionally their escape is made by running out along one of the branches of the plant in which the hut is located, and when the end is reached they jump to the ground and continue their flight. We have often followed out along their line of flight and sometimes have found another hut, but always, upon examination, these second huts have been found empty.

Rats are found in only about two-thirds of the huts opened up, although many of the others show signs of recent occupancy. Owners of some of these undoubtedly escape into tunnels under ground and are never seen, while perhaps others flee at our first approach and are unnoticed in the bustle of getting our lines formed about the hut. There are some huts, usually small ones, that are no longer used by the rats and in these we frequently find chemisal mice (*Peromyscus californicus insignis*). Usually a pair or more of the mice are found together, but not so the rats. There is never more than one brush rat in a hut except in the case

of a female with young. In the large number of huts opened there has not been a single exception to this rule. Yet in two weeks trapping at one rather small hut I caught seven adult males, two adult females, and two immature females.

In many cases other animals are found living in the hut with the rats. A number of Dulzura mice (*Peromyscus eremicus fraterculus*) have thus been found; three or four immature and one adult brush rabbits (*Sylvilagus bachmani cinerascens*) have been either taken or frightened from the huts; one adult harvest mouse (*Reithrodontomys megalotis longicaudus*) and one grey shrew (*Notiosorex crawfordi*) have been captured. All of these were found in the same huts with brush rats, while the chemisal mice are never found in a hut occupied by the rats.

A number of other forms of animal life are also found. Western fence lizards (*Sceloporus occidentalis biseriatus*) and alligator lizards (*Gerrhonotus scincicaudus webbii*) are frequently found darting in and out through the galleries and passages. Only one snake has been found, a gopher snake (*Pituophis catenifer annectens*) which was taken from one of the huts examined near Monte Robles. Slender salamanders (*Batrachoseps attenuatos*) were found in one hut and many tree frogs (*Hyla versicolor*) have been taken. In addition almost every hut has its quota of millipeds, spiders, beetles, bugs, isopods, and the beautiful snail (*Epiphragmorpha tudiculata*). I do not believe the rats eat any of these, as they are found in places to which the rats have ready access and the snails are frequently found estivating on the sides of the runways. Nests of bumblebees have been found in three or four of the huts. The black "woolly bear" caterpillar of the tiger moth is quite common in the huts during the late spring and summer months, and once a mourning-cloak butterfly, newly issued from the crysalis, flew from a hut as we opened it up. Numerous fragments of cocoons have been found, but these may have been brought in by the rats.

Almost every hut illustrates the "pack rat" proclivities of the inhabitants and quantities of old shot-gun shells, bones and skulls of chickens, rabbits and other small creatures, dung of coyote, dog, horse and cow, and pieces of cacti have been uncovered. I have seen no evidence that would support their so-called trading habits, although I have heard several seemingly authentic tales of such traits in this vicinity. Without doubt, they will carry to their hut almost any small object that they may find. Twice I have taken mouse traps from huts.

While collecting at Adobe Falls, some five miles east of the city, in the fall of 1926, I missed a mouse trap from where I had set it and at

once suspected a brush rat, the hut of which was nearby. Out of curiosity to see if my guess were correct, I decided to examine the hut and make a search for my trap. This hut was located in the very middle of a large clump of *Rhus laurina* and there were several runways leading away from it. As I was alone at the time, I set steel traps in all of the runways and then made my way back into the bush and commenced on the hut. I soon uncovered the trap I had lost, but not content with that I kept on and came upon an old tin wash-basin turned upside down in the very heart of the hut. At this point the rat ran out along one of the branches of the bush, passed my traps, jumped off at the end, and escaped. I turned the wash basin over and found immediately under it a snug little nest of shredded grass and bark, safe and dry from the severest storms. I trapped the rat the following night at a hole under the roots of a neighboring clump of sumac. There was not even a trace of a hut at this last location.

The following records of characteristic huts examined may be interesting: No. 2 on May 7, 1927; a small hut located in scrub oak; no mammals were seen; one brush rabbit skull, fresh leaves of toyon and *Ceanothus*, fresh blossoms of chamiso, dry oak twigs, one snail and one *Eleodes* (beetle). No. 4 of same date; large hut located in scrub oak; one brush rat escaped; skull, two leg bones, back, breast, feathers of large chicken; three brush rabbit skulls, foot and hair of rabbit, toyon leaves, fragments of acorn hulls, one empty cocoon, one milliped, two beetles, one bug, one shot-gun shell, spiders, two snails, coyote dung. No. 2 on November 4, 1927; located in sumac on hillside with deep hole into ground, base 3 by 6 feet, height 4 feet, three nests of shredded grass and shredded bark; no rats seen, but female trapped at hole the following night. No. 9 of November 4; located in scrub oak, 6 by 6 feet base and over 6 feet in height; one adult brush rabbit and one adult rat escaped, one harvest mouse taken; fresh chamiso twigs, dry *Ceanothus*, stems of berry clusters of sumac. This was a huge hut and so built into the branches of the scrub oak as to prevent our completing the examination of it. On the same date No. 8 was in wild buckwheat (*Eriogonum fasciculatum*), and was very small, being a mere handful of sticks with a neat nest exposed through a large opening.

Young are born at various times during the year and it seems probable that more than one litter is raised. I have a record of young with their eyes not yet open on March 14, and an adult female was trapped December 10 containing three large fetuses almost ready for birth. On November 4 several young not yet half-grown were found, and one female almost as large as an adult was taken.

The young, when small, cling tightly to the nipples of the mother and bump along behind her even when she is fleeing for her life. A captive female with three young was observed to disengage herself from the young by turning around and around until two of them has become detached, and the fore paws were used in freeing herself from the third. A student at the institute, Leroy Arnold, relates an interesting incident. He trapped an adult female under a house at Monte Robles and kept her alive in captivity. During the following day a loud squeaking was heard in an old bird's nest, high in the branches of a large live oak. The captive was much aroused by this and squealed in answer. Arnold climbed to the nest and found there a single baby brush rat with its eyes not yet open. He carried it down and placed it with the female he had trapped and it at once attached itself to one of her teats. She seemed pleased to have the little one with her again.

The fully adult males are large rats, averaging about 385 millimeters in length. The females I have taken average a little smaller, although the largest female is as large as the largest male, namely 393 and 394 millimeters long, respectively.

Most of the rats taken are infested with fleas and many of them have lice as well. About 50 per cent of the specimens taken in spring and early summer were carrying one or more of the large grubs or warbles of a species of fly, probably of the genus *Cuterebra*. Many of the autumn specimens were hosts to a small ,white dipterous larva resembling that of the common fly, but with two short projections on the posterior end.

Brush rats undoubtedly have many enemies, but our examination of the huts gave us little information along this line. We occasionally found a hut that had been torn into by a dog or coyote, and the fact that at times some of the rats would flee to the top of one of the neighboring scrub oaks or sumacs may point to their method of escape from such danger. I have found bones and hair of *Neotoma* in the pellets of barn owls in this locality, and since brush rats are at times active by day they may also be preyed upon by hawks to some extent. I note that in trapping for carnivores I have never made a single catch with brush rats for bait, while pocket gophers and ground squirrels seem irresistible. On several occasions I have baited my sets with the carcasses of brush rats as an experiment but they were never touched. On one occasion I placed a freshly killed rat on a trail used nightly by bobcats, coyotes, and feral house cats, and it remained untouched until devoured by fly maggots.

In the vicinity of Monte Robles, where some of the examinations were

carried on, the rats made their huts about the trunks of live oaks and occasionally had small huts up among the branches. These rats would flee to the tree tops when we attacked their homes and proved as graceful and agile among the branches as a squirrel. On one occasion a large male was watched for some minutes, as it sat crossways on a branch no larger than an ordinary lead pencil and balanced itself by means of its tail.

Many interesting observations have been made of captive specimens. While the East San Diego location is devoid of water during the summer months, captive rats drank copiously even when well supplied with succulent green food. They have a varied taste and are fond of leaves and blossoms, bread, apples, cheese, sweets such as jam, grain of all kinds, rolled oats, popcorn, and nuts. They refused to touch live flies or grasshoppers, dead mice, or raw meat. They will frequently turn cannibal, however, and kill and devour their own kind. On one trip four rats were captured and a male and female were placed in each of two cages. On the following morning both males were dead and partly eaten. A chemisal mouse placed in a cage with a brush rat was also killed and partly eaten.

A number of the specimens kept developed a serious disorder resembling piles and the lower intestine would at times protrude as much as six inches. This usually occurred on the fourth or fifth day after capture, and if left alone resulted in the death of the rat on the day following. Most of the rats were killed at once when this disorder was discovered. It was at first thought that this was caused by feeding rolled barley instead of their natural browse, but one adult and two young have been kept for over six months with no other food than the rolled barley.

The rats are very gentle and soon become tame. It is nothing unusual for specimens to eat from the hand of their captor on the third or fourth day of captivity. One unusually large male, in particular, ate from the hand and permitted himself to be gently stroked on the third day in the cage, and on the following day came to the door of his cage to welcome his keeper. When he resented being stroked he struck at the hand with his fore paws instead of trying to bite. Brush rats make very interesting and amusing pets, and I hope to have an opportunity to observe them further.

O'Rourke Zoölogical Institute, San Diego, California.

THE MOOSE AND RED DEER IN NORWAY

By Sigvald Salvesen

The moose (in Norwegian, elg or stordyr) still occurs in all the south-eastern, eastern, and middle parts of Norway (Sorlandet, Ostlandet and Trondelagen) where the natural conditions suit it. That it holds its place very well may be seen by table 1, which shows all bull and cow moose killed in Norway from 1889 to 1925. Wild reindeer and red deer are also included in this table.

In some parts of the country these animals are totally protected, and in other places only bulls may be killed, while cows and yearlings are protected. In the state forests the right to kill 151 moose was allowed in 1925 to sportsmen after competition. Seventy-four animals were killed of which 45 were bulls.

From time to time the moose is over-hunted in some districts, but after a few years' protection they come back again. The number of moose that may be killed on each farm is limited and each animal killed must be reported to the sheriff for statistical and controlling purposes. The open seasons at present are, as a rule, a few days from September 26 to 30.

In my home county, Aamli, Arendal, I have had a good opportunity to follow the extermination of the moose by over-hunting some ten years ago, and its coming back this autumn (1927). In my childhood about 1905 to 1912 the stock of moose was especially large. The animals in winter time often came quite close to the farmhouses or were met with on the public roads. Then the open season was from September 10 to September 30, too long a time to shoot these animals. The hunters formed hunting parties of from 15 to 20 men in each party. Across the valleys and hills they set out guard lines of shooters, while others drove the animals against the posted line. In this manner it was impossible for the moose to remain in his domain, and the last one was shot in 1917. Later on in this district no moose were seen until this October (1927) when a pair settled in the hills here. One morning a man met them on the moors near the River Nidelven when a dense fog lay over the landscape. Suddenly the man saw two huge heads among the willow and birch underbrush, one with mighty antlers and both with large, waving ears. The big animals were not afraid and continued biting off twigs and bark. After a little while they moved in the direction of the hills, and were only a few steps from the man. The animals had to pass the railroad, which was fenced on each side. The cow had been caught in the

wire and destroyed the fence posts for some yards. She lay down for a little and the railroad men observed it and warned the train arriving. When the train came the animals made for the hills, where their tracks now often may be seen. Also more moose have been observed, and probably under the total protection will rapidly increase in number.

The moose often come close to the cities and settled region. In 1913 I lived at Oslo, and in February I remember a moose came walking into the suburban western parts of the town. When jumping a high fence it broke a leg and had to be killed by the police. Also that year a moose

TABLE 1

YEARS	MOOSE			REINDEER			RED DEER		
	Bulls	Cows	Total	Bucks	Does	Total	Bucks	Does	Total
Average each year									
1889–1893	610	513	1,118			591			145
1894–1898	524	475	999			870			139
1899–1903	462	377	839			552			237
1904–1908	691	564	1,255			1,391			265
1909–1913	727	611	1,338	561	438	1,044	208	129	337
1914–1918	574	544	1,118	698	679	1,377	167	133	300
Total each year									
1919	326	326	652	508	476	984	172	99	271
1920	103	90	193	496	467	963	161	79	240
1921	26	31	57	459	366	825	166	108	274
1922	155	152	307	345	327	672	138	92	230
1923	433	299	732	251	243	494	123	74	197
1924	469	401	870	175	172	347	86	105	191
1925	691	495	1,186	209	235	444	97	88	185

came to Oslo and rambled about in the streets till it had to be shot by the police; it was brought to the butcher factory. In Vegaarsheia, the neighboring parish to Aamli, where my uncle is revenue agent, two years ago a bull moose was quite tame. It often came to a small farm where the man gave it bread and hay. The bull got so tame that the farmer tied a red ribbon it its antler. Nearly every day it came for its titbits, but at last it was rather ugly, and also began pasturing in the farmers' cabbage and potato fields. Especially it was ugly at horses, and one day with deep snow my uncle met it on the road. It attacked the horse, and only after several adventures did he reach his destination.

Some kilometers away was a little steamship pier and here also the bull moose made visits several times when the little steamer was calling and many people were present. Finally the bull had to be killed by the police because of its offensive habits.

Also at Hamar moose can often be seen in winter when food is scarce or beneath deep snow. In Furnes not far from Hamar a cow moose last summer showed too familiar habits on the little farm Nysveen. Five times the farmer had to drive the moose from his oat fields, but every time it came again and began to eat of the excellent food. But the owner decided to shoot the animal, and so he did, and reported it to the police. The cow was two years old. The remarkable fact is that the same animal two years previous was found newborn in the hog pen on the same farm. Here it was born while the inhabitants of the farm had been away, and later it often came back. On February 25, 1927, a cow moose with her calf came through the streets of the town at two o'clock in the afternoon. On the open place Stortorvet one of them jumped through a plate-glass window. Then both of them continued to the lake and out upon the ice. As the ice was so slippery, the calf could not progress. Some people helped it to the shore again and then both of the animals made for the forest.

A few days later 14 moose were seen walking together near Eidsvold. The animals were observed when they were crossing Lake Herdalssjzen on the ice.

Last fall the local steamer between Arendal and Kristiansand met a bull moose swimming in the North Sea, from the mainland to an island. It was some hundred yards for it to swim in salt water.

The Norwegian moose lives on roan-tree, sallow, aspen, willow, and birch, but less frequently on alder or bird cherry. Branches and leaves of these trees are according to Professor Collett its principal food. Also it eats fir leaves and juniper berries and leaves, and pastures in the swamps, where it eats several other plants. In the fall and winter it eats twigs and bark of the above-mentioned trees, sometimes also of Norway spruce, large quantities of ling (heather, bilberries, and red whortleberries) and before the snow comes roots of brackens and some other plants, which it kicks up with its sharp hoofs. Like the reindeer, the moose in winter eats some kinds of lichens.

Here in southern Norway are plenty of mosses, deciduous trees, and other suitable food for these animals. Some places in the eastern parts are more overgrown with fir and Norway spruce, and little or no deciduous trees are to be found. On account of this, in winter the moose

eats more bark and twigs of these trees and therefore often does much harm to the woods. In Furnes two years ago five acres of newly planted fir were quite destroyed by herds of moose. The trees were well cleaned of bark and twigs. The animals had also partly broken the trees and eaten the bark by biting over the trunk as low as possible and stripping the bark upwards. This damage might perhaps be avoided by letting deciduous trees grow more freely in swamps and in certain parts of the forests. In the eastern part of the country many farmers say they would rather have wood than moose meat and hides, because fir and spruce are too expensive food to give the animals.

The moose is so well protected in Norway that there is no danger of its extermination.

The red deer is to be found along the west coast of Norway, in the mountains and on the islands, where it is much hunted, especially on the great islands Froya and Hitra off Trondelagen. The red deer was nearly exterminated when thirty years ago Mr. Thams bought 20,000 acres around Sognligaard and protected all the wild life there, so that it forms a national park. In this varying ground consisting of backwoods of fir and birch with lakes and grazing grounds the red deer thrives very well. In the nineties there were only 2 or 3 red deer left, and now there are several hundred.

The reindeer is much worse off. These shy animals live in the vast areas above the tree level, but hunting and other activities have diminished their numbers very much. Reindeer are also bred in semi-domestic manner, and several of these animals have been transported to Alaska by the Norwegian-Americans, "the Lomen Brothers" at Nome.

The roe deer has come back to some extent in the southeastern parts of the country and also in the southwestern parts. On account of the cold winter climate these animals suffer much for lack of food which it has to excavate from under the snow. This year a short open season was allowed in the southeastern part of the country.

If the public were still more interested in the preservation of wild life, Norway might become a still better big-game producing country.

Aamli, Norway.

AMERICAN OLIGOCENE RHINOCEROSES—A POSTSCRIPT

By Horace Elmer Wood, 2nd

This paper is essentially a series of appendices to my earlier paper (Wood, 1927), consisting of material that can not, logically, be included in other papers now in preparation. It consists of a description of two interesting specimens of American Oligocene rhinoceroses in the museums of Munich and Berlin, which I came across during the summer of 1927, while making a comparative study of European fossil rhinoceroses, and a number of minor corrections of, and additions to, my earlier paper.

I wish to acknowledge my obligations to Drs. W. O. Dietrich, W. Janensch and J. F. Pompeckj of the Berlin Museum, and to Drs. F. Broili and M. Schlosser of the Munich Museum, for making these specimens available and for numerous other courtesies, and to Dr. G. G. Simpson, for a microscopic study of a sample of matrix. I am greatly indebted for the drawings to Dr. Florence Dowden Wood.

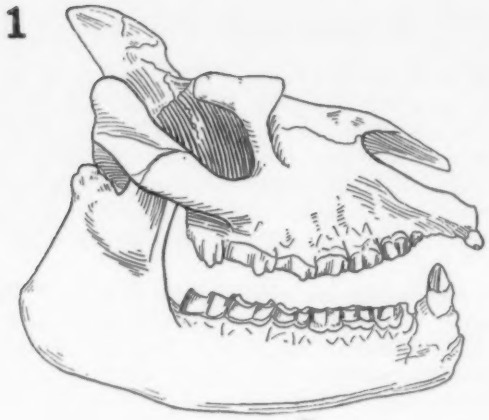
Eotrigonias rhinocerinus Wood, 1927

In my earlier paper (pp. 32–33, pl. 1) I did not consider the exact horizon of this species in the Uinta as being established. However, in answer to a question on this subject, O. A. Peterson states, in a letter dated April 26, 1928: "the mouths of Lake Fork and Duchesne streams are located in what has been regarded as horizon C of the Uinta Eocene sediments." The collector stated "near the mouth Lake Fork." It therefore seems justifiable to refer the type of *Eotrigonias rhinocerinus* to Uinta C with fair confidence. Its evolutionary stage would accord satisfactorily with this horizon at the summit of the Eocene.

Subhyracodon occidentale (Leidy). (Figs. 1–4)

This specimen, which I studied in the Munich Museum, no. 1897 × 18, a skull with the lower jaws, seems to represent a progressive stage of *Subhyracodon occidentale* (strictu sensu) foreshadowing *S. metalophum*. It is labelled *Aceratherium mite* Cope, from the White River Beds, Indian Creek, Wyoming, Geschenk v. Herrn Commerzienrat Th. Stützel. The original label gives the horizon as the Titanotherium Beds. Both Titanotherium and Oreodon beds are exposed to the south side of Indian Creek, Wyoming.

There is no trace of horn cores or rugosities. The premaxillaries are



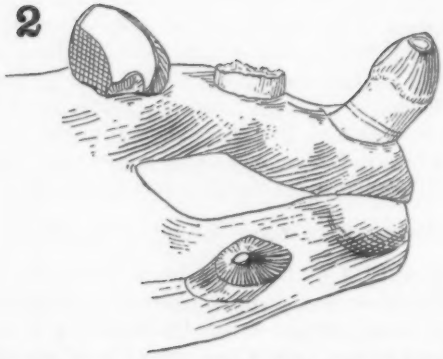


FIG. 1. Subhyracodon occidentale, Munich Museum, right side of skull about $\times\frac{1}{4}$. This figure is based on a lined-in and faded-out photograph furnished through the kindness of Dr. Schlosser. FIG. 2. Subhyracodon occidentale, Munich Museum, upper incisors and first premolar, crown view, $\times 1$.

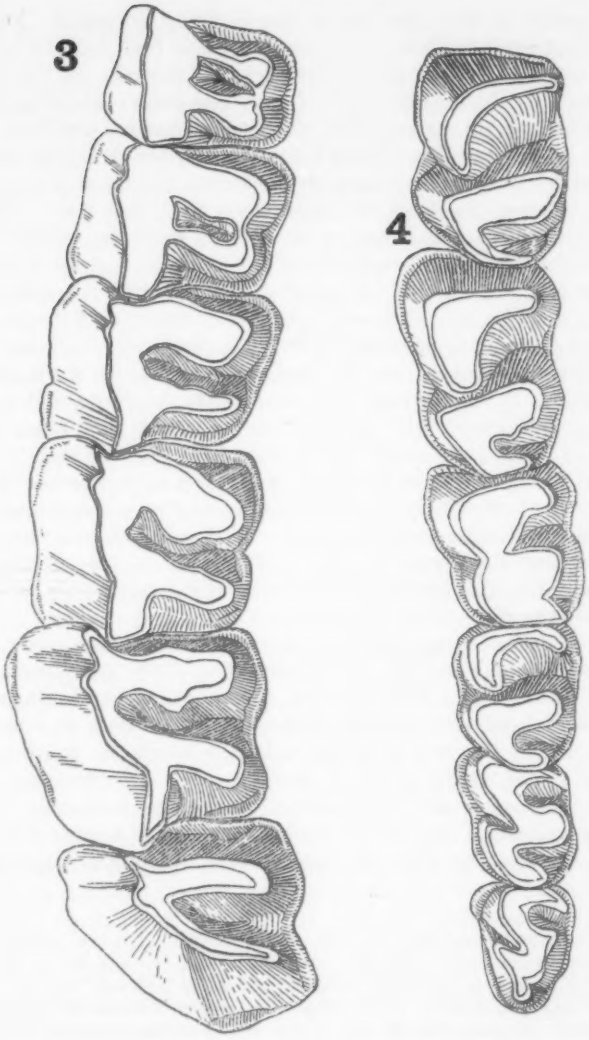


FIG. 3. Subhyracodon occidentale, Munich Museum, right P^2-M^3, crown view, ×1. FIG. 4. Subhyracodon occidentale, Munich Museum, right P_2-M_3, crown view, ×1.

in contact at their tips, but are not suturally connected. The skull, although complete, has been severely crushed from front to back, and the tooth dimensions are thereby slightly distorted. $I\frac{3}{3}$, $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. Right I^1 is abnormally small. It may not belong where it has been plastered on, but may represent RI^2 of this or another specimen. However, as the rear of the crown is worn, it is more likely that it is a dI^1, either from another specimen, or else that it had never been replaced. The internal cingula of the upper cheek teeth and the external and internal cingula of the lower cheek teeth are strong as in *Subhyracodon*, instead of weak as in *Caenopus mitis*. P^{2-4} have the cross lophs connected by mures. In the well advanced stage of wear of this individual, a connection, by way of the mures,[1] between the exposed dentine of the protoloph and the metaloph of P^{2-3}, has just barely been established. In P^4 the mure is still unworn, and the dentine areas of the lophs are separate. P_4 has the posterior crescent fully developed and elevated, so that, presumably, the entoconid was the highest point of the unworn talonid. In P_{2-3}, the entoconid is still materially lower than the hypoconid. I_2 is very erect, largely, however, as a result of crushing. The upper teeth are sufficiently crushed to distort their measurements somewhat, and all anteroposterior measurements tend to be too short. The lower cheek teeth were not appreciably distorted. The measurements given in the table compare fairly closely with *Subhyracodon occidentale;* allowing for the crushing, they compare very closely.

In all respects except the character of P^4, this specimen seems clearly referable to *Subhyracodon occidentale*. P^4 is of the type characteristic of *S. metalophum*. This specimen, then, gives strong confirmation to the traditional view that *S. occidentale* (rather than *S. trigonodum*) gave rise, by way of *S. metalophum*, to *S. tridactylum*. In my previous paper (Wood, 1927), I did not consider either alternative as proved. This specimen is also of considerable interest as suggesting a downward extension of the range of *S. occidentale* (and of a progressive stock, at that) into the Titanotherium Beds, if the original label can be relied on.

[1] The term "mure" was proposed by Troxell in "A Study of Diceratherium and the Diceratheres," Am. Jour. Sci., II, p. 202, text and fig. 6, Oct., 1921. "The premolars are distinctly bridged from loph to loph and united by a wall, which may be technically known as the *mure*, projected across the median valley effectively damming it up in such a way as to form the deep central pit completely surrounded by an enamel border."

Caenopus dakotensis Peterson. (Figs. 5–7)

This skull and lower jaws, in the Berlin Museum, is to be regarded as the plesiotype (or homeotype, according to taste) of *Caenopus dakotensis* Peterson. The skull was labelled "Aceratherium Copei Osb.," from the "White River Bad Lands." It was bought, probably from Dr. F. Krantz of Bonn or, possibly, from Mr. Stillwell of Deadwood, South Dakota. The level and exact locality are unfortunately not recorded. The matrix is definitely not of the "red layer" type; there is nothing inconsistent with its being Protoceras Beds, with a possibility of the Titanotherium Beds also to be considered. Dr. G. G. Simpson, of the American Museum, after a microscopic examination of a sample of the matrix, regards it as rather more probably Protoceras Beds than Titanotherium Beds, and agrees with me that there is slight probability of its being from the Oreodon Beds.

The front of the skull is lost, so that there is no evidence as to the presence or absence of horn cores. The inner edges of the temporal ridges were already well separated, being 11 mm. apart at their closest. The infraorbital canal opens over the crack between P^2 and P^3. The posterior nares open opposite the protoloph of M^2. The external auditory meatus was apparently widely open ventrally.

The teeth present are RP^2-M^3, LP^3-M^3, and both rami of the mandible with all the lower molars and the roots of RP_{2-4} and LP_{3-4}. The teeth of the two sides are unusually similar. Slight corrections from the left side are made in the drawing of RP^3-M^1. The upper teeth resemble *Caenopus mitis* more than any other known upper dentition, but are smaller and much more progressive. The lower molars agree very closely, both in measurements and character, with the type mandible of *Caenopus dakotensis* which was described and figured by Osborn (1898) and named by Peterson (1920), and which is also the only specimen hitherto made known. The weakness of all cingula, upper and lower, is a striking *Caenopus* character. The upper teeth have no external cingula, except a small one on the metacone of P^3. P^2 is much as in *C. mitis*. It is roughly quadrilateral, but somewhat longer at the external than at the internal border. The protoloph and metaloph are parallel and are separate down to a little above the level of the internal cingulum. Well-developed anterior and posterior cingula are present; the internal cingulum occurs only across the median valley. There is a slight internal swell to the paracone, which can be called a crista. There is a slight posterior hook to the metaloph. The parastyle and

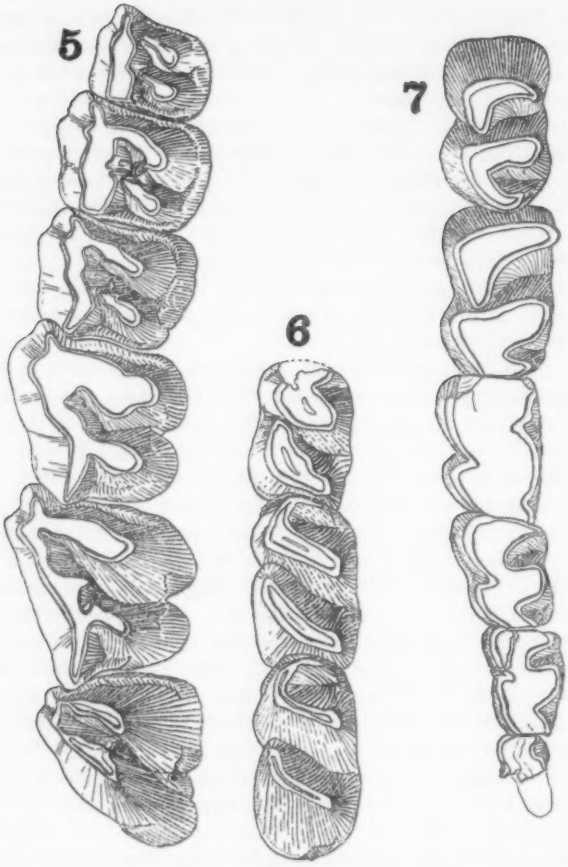


FIG. 5. Caenopus dakotensis, homeotype, Berlin Museum, right P^2-M^3, crown view, ×1. FIG. 6. Caenopus dakotensis, homeotype, Berlin Museum, left M_{1-3}, crown view, ×1. FIG. 7. Caenopus dakotensis, holotype, Amer. Mus. Nat. Hist. No. 1110, right P_2-M_3, crown view, ×1.

paracone are well demarked on the outer face of the ectoloph, the metacone only slightly. P^{3-4} are nearly quadrilateral. The anterior and posterior cingula are well developed and the internal cingula are present, although interrupted slightly by the protocone, and sharply by the hypocone. The metalophs trend toward the rear, paralleling the protolophs, and remaining fully separate down to below the level of the internal cingula. This more quadrilateral shape, the absence of a mure in P^4, and the greater demarkation of the lophs of P^3, all represent distinct advances over the condition in *Caenopus mitis*. In P^3 a mure extends back from the protocone nearly to the metaconule on the right side, and all the way on the left. There is a slight crista; and on the right side, there are two little accessory swellings, one on the crista itself, the other on the front of the metacone. P^4 has a sharp pseudocrochet, projecting forward from the metaconule, and a second minor fold, just internal to it. There is a slight crista with a small accessory swelling on its rear flank, on the left side; the right is obscured by a bit of firmly-attached matrix. Comparison of the premolars with those of *Caenopus mitis* suggests that the course of premolar metamorphosis was probably similar to that of *Hyracodon* (Sinclair, 1922; Wood, 1926; Abel, 1926; Wood, 1927), but this question must be left open until the earlier stages are made known. P^3, P^4, and M^1 still have the metacone faintly demarked externally. The various secondary folds on P^3, P^4, M^2, and M^3 all represent advances over the condition in *Caenopus mitis*. The upper molars have no external cingula, normal anterior cingula, and very short posterior cingula. M^1 has faint traces of an internal cingulum—two little projections on each side of the mouth of the median valley. The protocone is set off moderately from the protoconule, in front, and, slightly, to the rear. The antecrochet is of moderate size. A faint swelling on the metacone foreshadows the crochet. The protocone of M^2 is not well demarked, more so in front than behind. The antecrochet is scarcely distinguishable. A strong crochet projects from the metacone, and there are two smaller folds on the metaconule. Slight internal cingula run up the slopes of the protocone and hypocone, but are not confluent at the bottom of the valley. In M^3, the ectoloph and metaloph are fully confluent, with no trace of a posterior buttress. On the contrary, there is a faint ridge facing laterally. The protocone is not demarked, not is there any antecrochet. The sharp crochet almost closes the valley. The anterior cingulum is normal, the posterior cingulum is very short, and the internal cingulum is represented by a cuspule in the middle of the valley, partly continuous with a cingulum on the rear flank of the protocone.

There is no evidence whether P_1 was present or not, as the region is missing. Right P_{2-4} are represented by double roots. The lower molars are notable for the reduction of their cingula. The anterior cingula are of normal size, there are no external cingula, and no internal cingula except a trace in the valley of M_1. The posterior cingulum of M_1 is smaller than usual, still more so in M_2, and a rudiment in M_3. M_3 has developed a faint supplementary cingulum, externally, posteriorly, and internally, with a slight interruption by the rear of the metaconid. This cingulum, though faint, is continuous, and as it lies

TABLE 1

Cranial and upper tooth measurements

	SUBHYRACODON OCCIDENTALE—MUNICH		CAENOPUS DAKOTENSIS, PLESIOTYPE—BERLIN	
	R.	L.	R.	L.
Across Zygomas			151.5	
P^2-M^3			130.5	
P^{2-4}	e 64.0		52.8	
M^{1-3}	e 93.4	e 90.2	79.8	78.2
Length P^2			15.4	
Width P^2			19.7	
Length P^3			18.6	18.3
Width P^3			26.1	26.0
Length P^4			19.2	19.2
Width P^4			27.4	27.9
Length M^1			25.2	24.8
Width M^1			30.7	29.6
Length M^2			28.1	28.3
Width M^2			32.5	32.4
Length M^3			26.1	25.9
Width M^3			29.7	29.8

below the level of the other cingulum, it is apparently a new structure and shows how new cingula may arise. Otherwise, the lower molars have a thoroughly commonplace rhinocerine pattern.

The lower molars agree almost exactly with the type of *Caenopus dakotensis*, A. M. N. H. no. 1110, and I consider the identification as almost certain. Since Osborn's figure shows the side view only, a figure of the crown surface is included in this paper. The tip of I_2 has been broken off and lost, since it was figured by Osborn. This agreement is confirmed by comparison of the upper teeth with those of *C. mitis*, showing a more advanced stage of evolution of the same plan.

Although the stratigraphic level of this specimen is not recorded, its locality, "White River Bad Lands," makes it almost certain that it is Oligocene; and its stage of evolution is so far advanced that it is difficult to interpret it as being earlier than Upper Oligocene. Including the tentative determination of the matrix, all the lines of evidence converge to the conclusion that the Protoceras Beds are much the most likely horizon, and justify the reference to *C. dakotensis*.

Since the preceding was written, I have received, through the kindness of Drs. Pompeckj and Dietrich, an excellent cast of the skull and rami of the Berlin specimen. Comparison of the rami and their molars with the type, A. M. N. H. no. 1110, shows an exceedingly close resemblance. The type seems as if it would fit well with the cast of the upper teeth, but it is impossible to be sure, as the ascending rami are blocked by the cast before occlusion can be established. Comparison of the casts of the upper teeth with the palate which is the paratype of *Caenopus mitis* Cope show that P^4 and M^1 are very close; P^{2-3} and M^2 are generally similar but *C. dakotensis* is considerably more progressive. However, it is obviously the same plan in both specimens, and the two species unquestionably belong to the same genus.

Still a third specimen of this species has come to light. During the past summer (1928), I noticed a specimen in the Field Museum labelled "*Caenopus mitis*," no. P 12228, collected by the expedition of 1905 from the Protoceras Beds of the Big Bad Lands of South Dakota. I am permitted to mention this specimen here, through the courtesy of E. S. Riggs. It consists of a part of the skull of a small animal, about the size of *Caenopus dakotensis*, and in close morphological agreement with the Berlin specimen. Unfortunately, the cheek teeth were so badly worn during the animal's life that the pattern is virtually obliterated. I^2 C^1 (alveolus) P^4 M^3. I^1 is a small tusk. I^2 is a conical tooth elongated in the antero-posterior axis. A suture follows, posterior to which is an alveolus for the canine. P^{1-3} have the protoloph and metaloph parallel and separate down to the level of the internal cingulum. The pattern of P^4 is completely obliterated. The region of the internal cingula of M^{1-2} is broken, giving no information as to its character. The internal cingulum is faint on M^3, except on the posterior slope of the protocone, where it is well marked. M^3 probably had a crochet. All other features of the crown pattern have been obliterated by wear. It is to be observed then, that there is close agreement with the Berlin specimen in such characters as permit comparison.

Of the various European rhinoceroses, only *Eggysodon* (*Praecera-*

therium) *osborni* (=*reichenaui*) is at all likely to be even a fairly close relative of *Caenopus dakotensis*. The subject will be discussed in a later paper.

This line of small forms could easily have been derived from *Eotrigonias*. It seems possible, though not necessarily probable, that *C. pumilus* (Cope), now regarded as a synonym of *C. mitis*, may need to be reestablished for a smaller Lower Oligocene species contemporary

TABLE 2

Mandibular and lower tooth measurements

	SUBHYRACADON OCCIDENTALE—MUNICH		CAENOPUS DAKOTENSIS, PLESIOTYPE—BERLIN		CAENOPUS DAKOTENSIS—TYPE A.M.N.H. #1110	
	R.	L.	R.	L.	R.	L.
Symphysis					48.3	
P_2-M_3					e 124.5	
P_2-$_4$	65.0		r 47.0		e 49.4	
M_1-$_3$	95.3		77.0	76.6	74.8	76.6
Ramus, below P_2			35.9		38.8	
Ramus, below M_2			41.2	40.7	48.1	46.2
Length P_3					e 12.9	
Width P_3					8.8	
Length P_3					16.8	
Width P_3					e 12.0	
Length P_4					18.4	18.2
Width P_4					14.7	14.5
Length M_1			22.5	22.1	21.7	22.4
Width M_1			15.8	15.8	15.8	
Length M_2			26.2	26.2	26.0	27.2
Width M_2				17.3	16.9	16.4
Length M_3			28.6	28.7	27.0	27.2
Width M_3			16.4	16.5	15.4	15.0

e, estimated; r, along roots.

with *C. mitis* and ancestral to *C. dakotensis*. The very advanced character of the upper cheek teeth of *C. dakotensis* tends somewhat to confirm the hypothesis (first expressed by Peterson in 1920) that *Menoceras cooki* is derived from this line of smaller forms, instead of being a stunted off-shoot of the *Subhyracodon—Diceratherium* line. However, a new alternative now seems about equally plausible—that *Menoceras cooki* is an off-shoot of the European *Pleuroceros* group. This suggestion is based partly on similarities in the molar protocones,

partly on the lack of definite evidence for North American origin. There does not seem to be any valid a priori objection to *Menoceras* being independent of *Diceratherium*. *Menoceras* was probably a much more cursorial form (Wood, 1927, p. 58 and Table VII). Median horns have arisen independently in related lines of true rhinoceroses in identical positions. In the same way, paired horns have developed independently in *Colonoceras* and *Metahyrachyus*, in *Diceratherium armatum* (with its relatives), in *Pleuroceros* ("*Diceratherium*") *pleuroceros* (Duvernoy), and in *Pleuroceros* ("*Diceratherium*") *asphaltense* (Depéret and Douxami)—new combination. There is, therefore, no reason to assume that the paired horns of *Menoceras cooki* can not be an independent parallel specialization.

In this connection, it may be of interest to point out that Ringström (1924, 1927) refers certain of his Pontian and later Asiatic rhinoceroses to the genus *Diceratherium*. However, he specifies that it is a provisional correlation, using "*Diceratherium*" as a broad genus to include the European forms with paired horns (following Osborn and Depéret), for which I am reviving the name *Pleuroceros* Roger. (Incidentally, Palmer in his "Index Generum Mammalium" regards *Pleuroceros* Roger (1898) as preoccupied by *Pleuroceras* Hyatt (1868); but, according to the "International Rules of Zoological Nomenclature," article 36, this is not the case, and Roger's name is available). Whether Ringström's forms are congeneric even with *Pleuroceros* from the Oligocene (Stampian and Aquitanian) may be open to considerable doubt. I should place them, provisionally, among the Teleocerinae, keeping *Pleuroceros* in mind as a possible alternative. But they are certainly not related to *Diceratherium* (strictu sensu). Since writing this discussion of *Diceratherium*, I have received a paper from Borissiak (1927) in which he expresses the opinion that the European "diceratheres" are distinct from the aceratheres and perhaps from the American diceratheres.

In my former paper (Wood, 1927, p. 71) I failed to point out adequately that the recognition of a definite well preserved specimen of *Diceratherium armatum* in the Protoceras Beds of South Dakota helps to tie up the Great Plains succession with the John Day of the Pacific coast, and checks with previous ideas as to their correlation: that is, the lower John Day is roughly equivalent to the Protoceras Beds. On page 32 of this paper the fourth sentence in the second paragraph should read: "There are no internal cingula on P^3, M^1, or M^2. On the outer faces of P^3 and M^1, the metacone forms a well defined rib." I

am indebted to Dr. W. O. Dietrich, of Berlin, for calling my attention to the substitution of "single" for "simple" on page 83, line 4. Pages 86 and 87 are interchanged. In the chart (figure 1), I called *Menoceras cooki* and *Diceratherium niobrarense* "Upper Miocene." Actually, they are from the Upper Harrison, which would not generally be regarded as above the middle of the American continental Miocene, if that high. The relative levels of the various species are, however, correctly indicated. Prof. A. S. Romer of Chicago, very kindly called this to my attention.

In two papers (1926 and 1928) Dr. W. D. Matthew gives his most recent views, with phyletic trees, on the interrelationships of the main groups of perissodactyls. In their major outlines, I believe these trees represent an important advance. I am, however, totally unable to agree with placing even primitive amynodonts as ancestral to the true rhinoceroses. Neither the stratigraphic nor the morphological evidence would seem to accord with this view. I am also in partial disagreement with his opinions on the interrelationships of the Oligocene rhinoceroses (1928, p. 980, footnote).

SUMMARY

1. The traditional view that *Subhyracodon occidentale*, rather than *S. trigonodum*, gave rise to the later species of that genus, as well as to *Diceratherium* (strictu sensu), is now pretty definitely established.

2. *Caenopus dakotensis* Peterson, a small form, rather progressive for its time, and related to *C. mitis*, is now definitely established.

3. The ancestry of *Menoceras cooki* is still uncertain.

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DESCRIPTION OF A NEW RED SQUIRREL FROM NORTH CAROLINA

BY ARTHUR H. HOWELL

Specimens of the red squirrel from the higher parts of the southern Appalachians have been in the U. S. National Museum collection for many years, and have been recognized as belonging to a distinct race by several of our local mammalogists. On a recent visit to the mountains of North Carolina, I was impressed with the unusual conditions prevailing in the "cloud forests" of the higher peaks, where in the heavy spruce and fir forests these squirrels make their home. Apparently this region of heavy precipitation and almost daily fogs has produced a race darker than any of the other races of eastern North America.

Sciurus hudsonicus abieticola subsp. nov.

Type, ♀ adult, skin and skull, No. 193,638, U. S. National Museum, ($\frac{2\,2\,3\,4\,4}{2\,2\,5\,6}$ Merriam collection); Highlands, North Carolina, March 9, 1886; C. L. Boynton, collector; original number, 30.

Subspecific characters.—Similar to *Sciurus h. loquax*, but distinctly darker on head and sides, and the red of dorsal area a deeper shade; underparts in winter more grayish (less clear white) and more or less vermiculated with dusky (as in *hudsonicus*); skull averaging slightly larger than that of *loquax*.

Description of type (in winter pelage).—Ears and median dorsal area, from crown of head to base of tail, burnt sienna (of Ridgway, 1912), mixed with ochraceous-buff; sides mixed fuscous and ochraceous-buff (the general tone near buffy brown), bordered next the belly with a black stripe; nose and fore part of head between the eyes fuscous, mixed with ochraceous-buff; sides of head and face mouse gray; eye ring white; underparts grayish-white, vermiculated with hair-

brown; tail above, burnt sienna, mixed on sides with ochraceous-buff; legs mixed fuscous and ochraceous-buff; toes ochraceous-buff.

Measurements.—Type (from dry skin, the foot relaxed): Tail vertebrae, 133; hind foot, 50. *Skull.*—Average of 7 adults (4 ♂; 3 ♀) from type locality: Greatest length, 45.7 (44–47.1); zygomatic breadth, 26 (25.2–27); breadth of cranium, 20.1 (19.6–20.6); interorbital breadth, 14.7 (14–15.3); postorbital breadth, 14.9 (14.5–15.7); length of nasals, 14.1 (13.2–14.8); maxillary tooth-row, 7.7 (7.5–8).

Specimens examined.—Total number, 26, as follows: North Carolina: Highlands, 7; Roan Mountain (3,000–6,000 feet altitude), 17; Black Mountains (5,700 feet), 1; Mt. Mitchell (6,000 feet), 1.

Remarks.—This is the darkest of the races of *hudsonicus;* the characters are shown most strongly in winter pelage, but appear in lesser degree in summer pelage. The limits of range of the form are not known, but probably it is confined to the upper slopes of the southern Appalachians, where it dwells mainly in heavy fir and spruce forests.

A NEW SOUSLIK FROM MACEDONIA

By V. and E. Martino

Citellus citellus gradojevici subsp. nov.[1]

Type.—Collector's No. 22E (No. 519 Martino's collection), male; Djerdjelija, Macedonia; May 30, 1928.

Diagnosis.—Skull larger, relatively broader and more robust than in the European *Citellus citellus* (condylobasal length of skull 43–46 mm., average 44.5; zygomatic breadth 29.5–32.0 mm., average 30.4). General color (in spring pelage) of upper parts more yellow and uniform; the light hairs nearly buff yellow of Ridgway; the dark ones paler than in the northern form and not so numerous; color of underparts approaching buff yellow; dark subterminal band of tail rarely if ever blackish, usually brown (30 per cent) or light brown (70 per cent).

Measurements.—Type specimen: Head and body, 221; tail, 55; hind foot, 39.5; ear, 10.0. Skull of type specimen (teeth moderately worn): Condylobasal length, 45.4; zygomatic breadth, 31.8; interorbital constriction, 10.2; nasals, 16.4; diastema, 12.3; mandible, 31.0; maxillary tooth row, 9.6; mandibular tooth row, 9.2.

Remarks.—All specimens of old European ground squirrels in our collection (from Srem, Bačka and Banat) are very small (condylobasal length 39.8–42.5 mm.; zygomatic breadth 26.1–28.2 mm.). The aver-

[1] Named in honor of the collector, Dr. Mihajlo Gradojevic, docent of the university, Beograd.

age of condylobasal length of skull according to Obolensky[2] is only 40.7 (no exact locality). In the excellent work of Miller[3] are given cranial measurements for ground squirrels from Hirschberg, Bohemia, and Znaim, Mähren. The size of the first skulls is medium (condylobasal length 42.5), but the other skulls are comparatively large (average of the condylobasal length 43.7 and zygomatic breadth 28.8, instead 44.5 and 30.4 mm. of our subspecies). Perhaps among the sousliks to the north of the Danube River two forms may be distinguished, but we have not as yet sufficient material to determine this.

Topčider, Beograd, Jugoslavia.

GENERAL NOTES

A STAR-NOSED MOLE'S NEST AT NEWTON CENTRE, MASSACHUSETTS

On April 25, 1927, two workmen on our place at Newton Centre, Massachusetts, discovered the nest of a star-nosed mole, *Condylura cristata* (Linn.), with three young in the middle of a compost heap, which they were spading over.

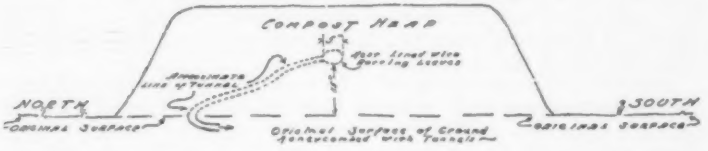
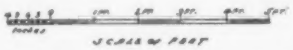


DIAGRAM OF NEST OF STAR-NOSED MOLE



This heap, which consisted of rotting leaves, and stood in a low, rather swampy place, just back of my flower garden, was perhaps about 10 feet across at its base, shaped like a truncated cone, and about 2½ feet high. The nest was very near the middle of the heap, and about 15 inches above the natural surface of the ground. The nest itself was a cavity, about 5 inches across, with flattened dome, an entrance tunnel leading into its side from the north, and was lined with rotten leaves. The tunnel, through the heap itself, had been partially demolished by the men before they discovered the nest, but we were able to trace

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[2] S. I. Obolensky. A preliminary review of the palaearctic sousliks. Comptes Rendus Acad. Sci. de l'URSS. Leningrad, 1927, p. 191.

[3] G. S. Miller. Catalogue of the mammals of western Europe. London, 1912, p. 924, 930.

its general course. The workmen described it as coming up from the original surface at a fairly even grade, and curving only a trifle in its course from its entrance into the heap, at a point which I found to be about 1½ feet from its northerly side.

The tunnel beneath the heap had come clear across it from the south, curving this way and that, dodging roots and rocks, and at varying depths, until it came up into the heap itself, where, in dodging a large root, it made a sharp elbow and turned directly south again, up towards the nest.

The young, of unknown age and about 80 mm. in length over all including 20 mm. tail, were hairless, with gray backs, shading into pinkish bellies, and, except for their powerful front feet, looked a good deal like miniature pigs. They are now in the collection of the Boston Society of Natural History.—Fred H. Kennard, *Newton Centre, Massachusetts.*

MICROSOREX HOYI IN CAPTIVITY

I caught a *Microsorex hoyi* in my hands in a field in the spring of 1927. About a hundred yards off was a little stream; no doubt my *hoyi* often ventured there. The first curious thing I noticed about this shrew was that he could wink his eyes at will. The species *Blarina brevicauda*, of which I happened to have one in captivity at the same time, did not do this. For the first five or six days that I had *hoyi* I noticed that he made no holes in the earth whatsoever. Here again was an unusual thing. The next time I changed the earth in the shrew's cage I put a flooring of moss over the usual earth. Strangely enough, he immediately dug a hole beneath the moss down into the earth. His hole could have easily been mistaken for that of a large earthworm.

Without doubt the most noticeable thing about *hoyi* was the musk that he emitted, especially when excited. It was very powerful and quite dominated the room in which I kept him. In fact it gave rise to complaints from many parts of the house, even though the window was kept open ten or more hours every day. After I changed his earth it became very noticeable again three or four hours afterwards. The *brevicauda* that I had did not emit any musk.

The cage in which I kept my *hoyi* was a tub two feet in diameter and eight or nine inches deep. I filled this tub up to five inches deep with earth. I then hollowed out a round depression about four inches in diameter and four inches deep. Next I lined this with sawdust as dry as possible to prevent the formation of mold which would otherwise grow there. I filled this depression with dry sphagnum and cotton. After this had been done a heavy board was placed over the hollow. If the board was not heavy enough the shrew would hump it up and down like a toy and would have difficulty in making his nest. After this a little jar was sunk so that the top was even with the level of the earth. The jar was then filled with water. A dish for food was unnecessary. If any food was put in his cage it was instantly pulled down into a hole. This does not mean that the food was eaten; it often rotted and became very odorous, as it consisted of raw fish, raw meat, and earthworms.

I have often seen my *hoyi* (we called him "Minim" for a pet name) sitting up on his hind legs like a kangaroo. This trick also I have never seen *brevicauda* perform. Sometimes at night, when I was just going to sleep, I used to hear

little high notes coming from the pigmy shrew's cage. These notes were a combination of whispering and whistling infinitely high on the musical scale. It was a most pleasant sound in the somberness of the night. *Brevicauda* also emitted these sounds but not so frequently.

One day Minim escaped and hid behind a bookcase. Had it not been that he got badly tangled in a spider web I might not have caught him again. I picked him up and he nibbled a little on one of my fingers; hardly what could be called a bite. I have tried this on *brevicauda* with the result that I was nicely bitten.

Hoyi was far more tame than *brevicauda;* I have rubbed my finger down his back and he has remained perfectly still. His speed above ground was incredibly faster than that of the *brevicauda*. Sometimes it was actually difficult for the eye to follow him. Minim's fur, like that of the big *Blarina*, was silvery and very beautiful.

Unluckily I was able to keep *hoyi* only about a month, April 5 to May 2, 1927. When I came to see him for my usual morning visit, on the latter date, I found him dead. The night before, I changed his earth and put in material for a new nest. I can not imagine what had happened to him. His death was a great grief to the whole family for he was the pet of everyone.

He weighed but 2.5 grams. My father and I dissected him and his little liver was about as big as half of a small French pea. All his other organs were of corresponding minuteness.

One of the outstanding features of my *brevicauda* was the amazing strength of his teeth. I noticed this characteristic at the time. He was kept in a tub of earth covered by two screens, the lower one, an ordinary fly screen, the upper one of a much coarser and heavier kind of wire. One afternoon I found him clinging by all four feet upside down gnawing on the coarse screen. He had already eaten a big hole through the lower fly screen.

There seems to have been a great decrease in the number of shrews in our woods in the summer of 1927. In the previous summer I set six traps and caught four shrews the first night. In the summer of 1927 I set five traps for two weeks and caught nothing at all. What is the cause of such variations? I heard this spring from W. E. Saunders that there has been just such an occurrence with field mice in the vicinity of London, Ontario. Here in Clinton, New York, the snowfall was unusually light during the winter 1926–1927. Could lack of food drive the shrews to other parts of the country? We know they can travel.—P. B. Saunders, *Clinton, New York.*

CRYPTOTIS PARVA, A NEW SHREW FOR THE CANADIAN LIST

Seven specimens of *Cryptotis parva* were obtained by E. B. S. Logier and H. P. Stovell, members of the museum's field party, at Long Point, Norfolk County, Ontario, during June and July, 1927. Four adults were collected, two, apparently a mated pair, being taken with a nest of leaves and dried grasses from beneath driftwood back of open, sandy beach on June 2. The other adults were taken in similar situations, and tracks which appeared to have been made by this species were noted on several occasions in the impressionable sand of the beach proper.

The three young secured were regurgitated by a captive milk snake, *Lampropeltis triangulum*, while it was being chloroformed in the camp laboratory. The

shrews had been but recently swallowed, one individual reviving completely and another showing signs of life when it was first cast out by the snake. These young, all about equal in size, were probably from the same litter and may have represented a complete litter as escape from the snake by other young shrews of this age seems unlikely.

The specimens were recognized as being unique within the experience of the members of the field party, and were later identified as *Cryptotis parva* by Dr. H. H. T. Jackson. The species has not been recorded from Canada previous to this note, but it seems probable that it may be taken in other situations, especially westward, along the north shore of Lake Erie.—L. L. SNYDER, *Royal Ontario Museum of Zoology, Toronto, Ontario.*

MIDWINTER RECORD OF THE WOODCHUCK IN WESTERN PENNSYLVANIA

In summarizing the information then available on the hibernation of marmots, Arthur H. Howell, in his "Revision of the American Marmots" (North Amer. Fauna no. 37, 1915), gives extreme dates of occurrence of the woodchuck in New York as February 22 and November 20, and at the base of Roan Mountain, North Carolina, as February 7 and October 23. As a search of the JOURNAL OF MAMMALOGY and other pertinent literature fails to reveal any extension of these extremes, the following midwinter record of *Marmota monax monax* (Linnaeus) in western Pennsylvania is considered worthy of publication.

On January 1, 1928, despite the blizzard that was blowing at the time, Richard J. Freni and Paul C. Ross went out to examine a trap that they had set four days before (i.e., December 27) in a hole in a sheep pasture near Sandy Lake, Mercer County, Pennsylvania. To their astonishment the trap held a medium-sized "ground hog," frozen to death.

Upon first thought it seems nothing short of amazing that a woodchuck should venture out in the severe weather that ushered in the new year in western Pennsylvania. It will be noted, however, that the trap was set on December 27; and reference to official weather charts shows that the temperature started to rise after Christmas and on December 30 reached as high as 56°F. at Pittsburgh. It is very probable, therefore, that the animal came out during this warm spell and had been in the trap a day or two when it was found.

This note is published through the courtesy of Mr. Freni.—ERNEST G. HOLT, *Carnegie Museum, Pittsburgh, Pennsylvania.*

THOMOMYS BOTTAE LATICEPS IN OREGON

During September, 1926, while I was passing through the southern part of Curry County, Oregon, my attention was attracted to a number of freshly thrown-up *Thomomys* mounds just south of the Oregon state line. My interest was aroused when I realized that *Thomomys monticola helleri* was the common form of pocket gopher found from the mouth of Rogue River south along the coast of Curry County, but that no *Thomomys* had been recorded south of the Winchuck River in Oregon. Opportunity for specimens presented itself when I was again in that section on July 25, 1927. That evening, camp was made at the state line and two traps were set in a hay field just north of the line in Curry County, Oregon. Old mounds were plentiful in all the open fields in that section but,

owing to the dry, hot weather for the past few weeks, the gophers were not so active as they were when noted during September, 1926. Two specimens, one adult male and one young female of the year, were taken and forwarded to the U. S. Biological Survey. Vernon Bailey identified my specimens as typical *Thomomys bottae laticeps*. This subspecies has never before been recorded from the state of Oregon.—STANLEY G. JEWETT, *Portland, Oregon.*

EXTRA-UTERINE PREGNANCY IN PEROMYSCUS

Upon examining the skinned remains of a female *Peromyscus maniculatus sonoriensis*, found dead near some strychnined oats at the Mammoth Ranger Station on the Manti National Forest, Utah, for indications of breeding condition and size of litter, as denoted by uterine scars or developing fetuses, the writer observed an apparently foreign body within the peritoneal cavity. Examination of the object, which was grayish-brown in color, showed a fetus apparently fully developed and enveloped in the chorion. No placental attachment was present.

The uteri contained five fetuses with an average dilation of about half an inch, the stage of development of which was about half that of the larger fetus found within the peritoneal cavity. The position of the latter was in the apex of the V formed by the dilated uteral horns and upon the ventral floor of the cavity. Its position relative to presentation was not noted.

This material was sent to the U. S. Biological Survey and was referred to A. Brazier Howell. In a letter to me regarding it he stated that the five fetuses, with crown-rump measurement of approximately 12.5 mm., corresponded in size of uteral dilation to *Microtus* (no *Peromyscus* of known ages available) at the thirteen-day stage, but were somewhat more developed—say about sixteen days. The larger fetus, with crown-rump length of 20.5 mm., he considered to be within 24 hours of term. In addition Mr. Howell stated that "Save for the darker color there was no indication of decay in the anterior half but posteriorly there was some breaking down of the tissues, a condition I have sometimes noted when a young mammal has died during faulty and prolonged parturition. This was hardly possible in the case of the mouse, however, for it was still enveloped in the chorion, you said."

The signs of decomposition noted are probably explained by the fact that the larger fetus was partially divested of its sealed chorion and placed in damp cotton, which in turn was placed in a snowbank until it was possible to obtain a suitable solution for preservation, the intervening period being about 25 hours.

Mr. Howell states that ectopic or extra-uterine pregnancy is of such rare occurrence that any instance of its observance in the lower mammals should be recorded.—A. W. MOORE, *U. S. Biological Survey, Portland, Oregon.*

RECORDS FOR PHENACOMYS UNGAVA IN ONTARIO

By an interesting succession of circumstances additional fragmentary information regarding the rare *Phenacomys ungava* in Ontario has come to light. The field party from the Royal Ontario Museum of Zoology at Lake Abitibi during the summer of 1925 had as one of its objectives the procuring of specimens of *Phenacomys ungava ungava*. Traps were regularly set in a variety of situations,—dry, wet, wooded, and open, in cabins, and along the railroad right-of-way. A

normal assortment of small mammals was secured, some ordinary and some not so ordinary, but no *Phenacomys* were obtained. During the past fall (1927) a request came to the museum from the U. S. Biological Survey for stomachs of raptorial birds. Among others the stomachs of several hawk owls from Lake Abitibi were forwarded to Washington. In due course examination of the stomachs was made by Remington Kellogg who forwarded his findings to the writer for the museum's files. Three of the Abitibi hawk-owl stomachs contained remains of *Phenacomys ungava ungava*, as did also the stomach of a hawk owl from Little Current, Manitoulin District, Ontario. The owls from Lake Abitibi, without question, had secured their fare in the immediate vicinity of the place where they were collected, being members of family groups that do not wander far in summer. The Little Current specimen may have secured its prey some distance from where it was collected on December 7, 1926.

These two localities are important as they fill in the stated range as given by Howell.[1] Previous Ontario records have been made by Miller[2] and Saunders.[3]—L. L. Snyder, *Royal Ontario Museum of Zoology, Toronto, Ontario.*

AN ALBINO FIELD MOUSE

I have recently received from Charles F. Frey of Maher, Montrose County, Colorado, the skin of an albino dwarf vole, *Microtus nanus*. The specimen is white everywhere, with no dark hairs, and in life the eyes were pink. Mr. Frey told me that the animal was killed when it ran out from under a haycock on his ranch in the summer of 1927. Although I have collected and handled many specimens of the various species of *Microtus* found in Colorado, I have never before seen an albino, nor seen an animal that had any indications of albinism. I am, therefore, inclined to think that this condition is rare in this genus.—Edward R. Warren, *1511 Wood Avenue, Colorado Springs, Colorado.*

OCCURRENCE OF A TRUE FOURTH MOLAR IN A MODERN HORSE

As is generally well known, the grinding teeth of placental mammals consist of four premolars and three molars in each jaw, above and below, unless evolutionary reduction has occurred in the particular race in question. In modern horses, and even in their fossil progenitors, back well into Miocene times, the first premolar has been reduced or lost, the second premolar altered into a tooth of very characteristic and distinct form, and the last two premolars completely molarized in pattern.

The Colorado Museum of Natural History field party that collected fossils in northwestern Nebraska during the summer of 1927 picked up and brought in a large modern horse skull and lower jaws, in which a well developed fourth molar is present in the right lower jaw as an accessory tooth, in line behind the

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[1] Howell, A. B., Voles of the Genus Phenacomys, North Amer. Fauna, no. 48, 1926.

[2] Miller, G. S., Notes on the Mammals of Ontario, Proc. Boston Soc. Nat. Hist., vol. 28, pp. 1–44, 1897.

[3] Saunders, W. E., Phenacomys ungava in Ontario, Journ. Mammalogy, vol. 8, no. 4, pp. 305–307, 1927.

regular set and somewhat crowded by the ascending ramus. A careful examination of the specimen makes it certain that there can be no mistake in this determination of the tooth. Such a tooth is so unusual that it seems worth noting briefly as a record.

The extra tooth in type is very much like M_2 preceding it, save that the posterior half is constricted and pinched so that the hypolophid, and all its component parts, including the hypoconid, entoconid and stylids, are modified. These changes are primarily a matter of size, and so a matter of degree, rather than kind, in their differences from a normal molar. No other abnormality is noted either in the rest of the dentition, or in the skull or jaw characters.—HAROLD J. COOK, *Colorado Museum of Natural History, Denver, Colorado.*

EAGLES' PREY

On the plains and in the mountains of the western country the eagle most often observed is the golden eagle. Once in a while, on the Missouri and possibly on other large rivers, the white-headed eagle may be seen and sometimes breeds.

Among the mammals that the golden eagles kill for food are jack-rabbits, some smaller rodents, and the young of deer, antelope, wild sheep and white goats. In the old days of antelope abundance, plainsmen frequently told of attacks by eagles on well grown antelope. I myself once saw an eagle stoop at two yearling antelope that were running side by side. When threatened, the antelope reared on their hind legs, struck with their feet at the eagle and drove it off. I quoted, years ago, a similar observation by my friend, W. H. Reed. In old times, eagles killed many antelope.

A hungry eagle may well enough attack any living thing it thinks it can kill. It requires flesh and is not critical as to what this is. Two or three observations on this point, reported from Montana, seem worthy of record. The first comes from G. Monroe, son of J. B. Monroe of Blackfoot. In the spring of 1926 young Monroe was riding from his father's house on the St. Mary's Lakes, Montana, toward the home of William Gird, who lives further down the St. Mary's River. When he had passed just below the mouth of Hausman Creek, he saw a full-grown coyote trotting along on an open hillside about four hundred yards from him, apparently hunting ground squirrels. Young Monroe had no gun with him and rode on. As he watched the coyote he heard a rush through the air and saw a large eagle descend and strike the coyote over the kidneys with its talons, and seem to try to rise with it. At all events, it vigorously fanned the air with its wings. The eagle continued to hold the prey which presently ceased to struggle. The young Monroe rode over to the place and drove the eagle away from the dead coyote and later he and Gird examined the animal. Its throat was torn.

On an occasion when the wife of J. B. Monroe was returning from Two Medicine River she saw an eagle attacking a large badger. Apparently the eagle would soon have killed it, but the woman drove off the bird and the badger got into a hole.

A coyote and a badger are fighting animals and might be expected to try to defend themselves, but no resistance to an eagle could be made by a young deer, a mountain lamb, or the kid of a white goat.—GEORGE BIRD GRINNELL, *238 East 15th St., New York, N. Y.*

MAMMAL NOTES FROM RANDOLPH COUNTY, GEORGIA

Most of southwestern Georgia forms a blank space on maps of mammalian distribution, at least as far as specific locality records are concerned. This condition of affairs may be considered a justification for submitting the scant notes that follow. They were secured during the period from March 16 to April 18, 1921, and they pertain, unless otherwise specified, to a locality about 7 miles northeast of Cuthbert, the county seat. Here the cultivated fields and the pastures probably cover a somewhat greater area than the patches of woodland. Pines, oaks, bays, sweet gum, and tulip are some of the commonest trees.

A few reports from adjoining counties are included.

1. **Eptesicus fuscus fuscus** (Beauvois). Big brown bat. On April 2, at twilight, I shot two among a few bats seen flying about the woods along a small "branch." Each proved to be a female of this species. One of them contained four 2-mm. embryos (two right, two left).

2. **Euarctos floridanus** (Merriam). Florida bear. While I heard of no bears in Randolph County, some were reported on the eastern boundary of the adjoining Calhoun County, at a place called "Pine Island."

3. **Mustela peninsulae olivacea** Howell. Alabama weasel. Weasels, doubtless of this form, were reported.

4. **Spilogale putorius** (Linnaeus). Alleghenian spotted skunk. I examined the hide of a recently taken specimen, and heard reports of others. The local name is "polecat."

5. **Lynx rufus floridanus** Rafinesque. Florida wildcat. Wildcats were reported along a near-by creek. A local butcher was said to expect an old wildcat to prowl about his place every time he slaughtered a beef. It would often encounter his dogs, and not come off worst in the fray.

6. **Tamias striatus striatus** (Linnaeus). Southeastern chipmunk. "Ground squirrels" were reported as common in oak woods. The description given left no doubt as to their being chipmunks. This is very likely the southernmost locality in Georgia from which the species has been reported, though it is known from still more southerly points in Alabama (cf. Howell, N. A. Fauna No. 45, 1921, p. 62). During five years (1892 to 1897) spent at Americus in Sumter County, about 40 miles northeast of Cuthbert, I never saw or heard of chipmunks. Possibly they have extended their range southward in the meantime.

7. **Sciurus carolinensis carolinensis** Gmelin. Southern gray squirrel. On March 27 two half-grown gray squirrels were seen playing about a nest in a tall, slender tree in a creek swamp, at a height of about 40 feet.

8. **Geomys tuza tuza** (Barton). Georgia pocket gopher. These "salamanders" were reported in sandy land near Barges Mill, in the northern part of the county.

9. **Sigmodon hispidus hispidus** Say and Ord. Eastern cotton rat. On March 28 a specimen was captured by a farm hand along the roadside, and on the following day one was caught by a hound in a field.

10. **Neotoma floridana floridana** (Ord). Florida wood rat. A "swamp rat," building nests of sticks in vines or on the ground, was reported, and could be nothing else but this species.

11. **Mus musculus** Linnaeus. House mouse. A house mouse was captured

as it ran out of a bed of sugar cane leaves in a field. Another was seen in a business office in Cuthbert.

12. **Sylvilagus floridanus mallurus** (Thomas). Eastern cottontail. I saw one cottontail along a roadside, and shot another in a garden, where its presence was undesirable.

13. **Sylvilagus aquaticus aquaticus** (Bachman). Swamp rabbit. Swamp rabbits, probably of this form, and known locally as "swamp bucks," were said to frequent cane-brakes. The species has been taken at Lumpkin in the next county on the north (Nelson, N. A. Fauna No. 29, 1909, p. 273).

14. **Odocoileus virginianus virginianus** (Zimmermann). Virginia deer. Deer were reported on Pine Island, at the eastern boundary of the adjoining Calhoun County. Persons from Randolph County were said to go there nearly every year to hunt deer.—FRANCIS HARPER, *Boston Society of Natural History, Boston, Massachusetts.*

A CORRECTION

In the August, 1928, number of the JOURNAL, vol. 9, p. 212, in my article "Additional Notes on the Life History of the Goss Lemming Mouse," the last sentence of the first paragraph should have been omitted. It reads, "As a source of life-history information, the article by Quick and Butler (Amer. Nat., vol. 19, pp. 113–118, 1885) might well have been included with Howell's bibliography of *Synaptomys*." Mr. Howell does include this reference in his bibliography. The error was due to an oversight.—W. H. BURT, *Berkeley, California.*

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WARREN, EDWARD R. Little mountaineers in fur. Trail and Timberline [Denver], no. 117, pp. 2–3. July, 1928. (Popular account of some Colorado mammals.)

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REPORT OF THE J. A. ALLEN MEMORIAL COMMITTEE

The Central Committee for the J. A. Allen Memorial Fund, upon the successful conclusion of the campaign at the annual meeting of the American Society of Mammalogists in April, 1928, turned over to the trustees of the society all of the assets of the fund. The following brief report by the committee gives condensed data bearing on the fund and shows the disposition of securities and cash. A detailed account of the campaign, with names of donors, will appear in the first memorial number published by the proceeds from the fund.

Number of contributors	273	
Amount raised by contributors	$8,428.78	
Amount gained by bond coupons and interest on savings account to November 3, 1928	1,848.90	
Total amount in fund	10,277.68	$10,277.68

List of bonds held by the J. A. Allen Memorial Fund

Purchased August 27, 1924	
$1000—Baltimore & Ohio Railroad Co., First Mortgage 50-year 4% Gold Bond, due July 1, 1948—at 87	887.83
$1000—Delaware & Hudson Co., First and Refunding Mortgage 4% Gold Bond, due May 1, 1943—at 87¾	892.00
$1000—New York Central Railroad Co. 5% Refunding and Improvement Mortgage Bond, Series, "C," due October 1, 2013—at 98¼	1,009.42
$1000—Southern Pacific Railroad Co. First Refunding Mortgage 4% Gold Bond due January 1, 1955—at 88½	889.08
$1000—Norfolk & Western Railway Co. First Consolidated Mortgage 4% Gold Bond, due October 1, 1996—at 88½	902.83
Purchased June 2, 1926	
$1000—American Telephone & Telegraph Co. 29 Year Sinking Fund Debenture, 5½%, due 1943—at 106½	1,069.39

$1000—Atchison, Topeka & Santa Fe Railway Co. General Mortgage 4% 100 Year Gold Coupon Bond due 1995—at 92¼	$931.39	
$1000—Norfolk & Western Railway Co. First Consolidated 4% Gold Bond, due 1996—at 92¾	932.64	
$1000—Pennsylvania Railroad Co. General Mortgage, Series "A," 4½%, due 1965—at 98¼	983.50	
Cost of bonds	8,498.08	
Cash in Savings Bank, November 2, 1928	1,779.60	
Total	10,277.68	$10,277.68

All of the bonds held by the fund are deposited in a safety deposit box in the Colonial Bank, Broadway and Seventy-ninth Street, New York City.

The cash account is carried in the Greenwich Savings Bank, Broadway and Sixth Avenue at 36th Street.

MADISON GRANT, *Chairman,*
Central Committee for the J. A. Allen Memorial Fund
H. E. ANTHONY, *Secretary and Treasurer.*

COMMENT AND NEWS

The ELEVENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS will be held in room 3024, University Museums, University of Michigan, Ann Arbor, Michigan, from Wednesday, April 10, to Saturday, April 13, 1929. In addition the meeting of the directors will be held at 8.15 p.m., Tuesday, April 9, also in room 3024, Museums Building.

Reservations may be made in advance at the Hotel Allenel, ten minutes walk west of the campus. Rates vary from $2.00 for a single room to $5.00 for a double room with bath. Or members may procure accommodations in the numerous rooming houses about the campus by making application when registering.

It is expected that this meeting, our first held elsewhere than on the Atlantic slope, will prove very stimulating to the middle western interests of the society and it is urged that as many members as possible from all sections endeavor to attend.

In order that papers to be read should appear upon the program, it is necessary that all titles be in the hands of the corresponding secretary not later than March 12. Time of delivery should be limited to 30 minutes unless involving unusual slides or films.

Members should note that there will be no preliminary notice of the meeting mailed individually this year, and that this is the only notification that they will receive.

Local committee on arrangements: Clarence C. Little, William P. Harris, Jr., Peter Okkelberg, Alvin G. Whitney, Lee R. Dice, *Chairman.*

At the annual meeting of the New York Zoölogical Society on January 8, 1929, the following resolution was passed:

WHEREAS, one of the primary objects of the New York Zoölogical Society is the preservation of our native American animals; and

WHEREAS, the indiscriminate killing of predatory animals without a thorough study of their value in any given area is unscientific and unfair; and

WHEREAS, the introduction of exotic species may become a dangerous factor in disturbing the balance and natural condition of our native American game, therefore, be it

RESOLVED, that the New York Zoölogical Society, while recognizing the fact that a certain control of predatory animals is at times necessary, is strongly opposed to the extermination of any single species of our American wild life; and be it further

RESOLVED, that the federal government be urged to adopt for our national parks a policy whereby all the wild life should be studied intensively with a view to determine scientifically to what extent its regulation is advisable and that the policy of destroying the predatory animals be suspended until such policy has been considered, and that this society tender its services to the national government for the purpose of aiding in the efforts to reach a proper decision, and be it further

RESOLVED, that the New York Zoölogical Society strongly opposes the introduction of non-native animals into our national parks and urges the National Park Service to prohibit all such introductions.

The following report and resolutions were adopted by the Boone and Crockett Club on January 10, 1929:

An examination of many of the annual reports of the superintendents of our great national parks shows that there is need of a better understanding of the management of parks as sanctuaries for wild life.

While the general idea is that all animal life existing in the parks should be undisturbed by outside agencies, it is apparent that such a condition is not always to be found.

In the Yellowstone Park, during a certain period, one hundred coyotes were destroyed every year. In going over the reports on other parks we find that predatory animals of most kinds are usually not considered desirable in sanctuaries for wild life. The idea of preserving the *game animals only* is uppermost with many of these well meaning men.

We find in the reports such statements as these:

"Every effort is being made to exterminate predatory animals."

"Predatory animals are steadily being hunted down."

"We are carrying on our campaign to eliminate cougars, bobcats and wolves so destructive to game."

"We must destroy all animals that prey on game."

They are prone to draw a line between *game* and other animals.

This does not fit in with our theory of absolute sanctuary for wild life. It is drastic interference with natural conditions, and it does not fit in with the idea of the laws that created such sanctuaries.

In many cases the officials in charge is trying out his own ideas with the best intentions, in the absence of a general policy based on accurate knowledge of local conditions. It is time to suspend all experiments of this kind until we know just what we are doing.

There is interference of this kind outside the parks. When extensive killing of coyotes as in eastern Oregon for instance is followed by a plague of jack rabbits and ground squirrels, taking 10 per cent of the crops, it is time to reconsider.

Predatory animals have an interest of their own. We have only a superficial knowledge of the complicated relations between them and the animals among which they live.

Wild life belongs not only to the sportsmen but to all the people.

The age of animals is passing. The only safe policy for our parks is absolute sanctuary for all species.

The extermination of any vertebrate species is indefensible. We have not gone so far that ill-advised experiments can not be stopped.

Local bans on certain animals may be permissible but not *until after impartial study* in each case.

It is not for park officials to say what animals in a sanctuary should be killed off.

The smaller predatory fur bearers have been greatly decimated as a result of the demands of the fur trade. They should have absolute sanctuary in all parks.

WHEREAS, the object of the national parks is the preservation of such areas in their natural condition, and the preservation of the forms of wild life inhabiting them, for the recreation and enlightenment of the people, and

WHEREAS, there is a strong tendency toward interference with animals of predatory habits, resulting in the disturbance of natural conditions, and

WHEREAS, there is no general and well defined official policy for the guidance of officials in charge of national parks, now, therefore, be it

RESOLVED, that the Boone and Crockett Club is opposed to the practice in some of the national parks of drawing a line between game animals and those of predatory habits, to the detriment of the latter, and be it further

RESOLVED, that this association urge upon the federal government a policy for the National Park Service, whereby all predatory animals in these parks be allowed to retain their primitive relations to the rest of the fauna, and be it further

RESOLVED, that scientific studies of the animal life in all parks be undertaken with the view to maintaining such life unimpaired by influences that may be detrimental.

In this number of the JOURNAL (p. 93) will be found a report of the J. A. Allen Memorial Committee. The committee and society are to be congratulated on accomplishing an outlined program. Note, however, that the number of contributors to the fund is only 273. And let us confide that fully one-third of these are *not* members of the society, which now enrolls approximately one thousand. The entire income from the fund will redound in the form of improved publications to the benefit of individual members. No officer of the society receives any remuneration whatsoever; each one labors gratuitously for the cause, often under midnight electricity and to the neglect of other things he would like to do. If you

desire to be a partner in the work, and have not been able to accept the opportunity, it is not too late. Your contribution, small or large, may be sent to the secretary of the committee, H. E. Anthony, American Museum of Natural History, New York City.

The stock report of the International Society for the Preservation of the Wisent for 1927 shows that, while the year 1926 brought great losses in consequence of the foot and mouth disease, no animals died in 1927. There were six births, two bull and four cow calves.

A summary of the two years shows the following:

1927	1926
19 bulls (2 incapable of reproduction)	18 (1)
20 cows (3 incapable of reproduction)	16 (3)
4 young bulls (of 1925)	3
2 heifers (of 1925)	4
4 bull calves (since January 1, 1926)	6
7 cow calves (since January 1, 1926)	5
56 (27 males, 29 females)	52 (27 males, 25 females)

For the first time since the founding of the society there are more females than males. The advance news for the year 1928 shows that the improvement is continuing and that the number of cows that have a calf annually is increasing.

The efforts towards uniform breeding methods also show progress. A pure-blood bull was obtained for the pure-blood cow in Copenhagen, and it is to be hoped that Sweden will also get one for its cows, in consequence of which a still greater increase could be expected.

In 1926, at the meeting of the society in Vienna, it was decided to include the matter of wisent hybridisation in its duties and to create a registry of all hybrids known that have at least 50 per cent wisent blood; cows, only come under this consideration. On December 31, 1927, twenty-four such animals were registered, of which fifteen were in Ascania Nova, southern Russia. However, there were only sixteen of which one parent was a pure-blooded wisent; for the remaining eight, the required 50 per cent was obtained by adding the theoretical amount of wisent blood in both parents. Obviously these latter scarcely come within the grade.

An article on "The End of the Caucasus Wisents" by Prof. J. Pujanow, of Semferopol, has been published in *Naturschutz*, volume 9, number 11, 1928, a translated summary of which, through the kindness of Dr. Theodore G. Ahrens, we are able to present as follows:

The fate of the now extinct Bialowics wisents and of those of Pless, of which five remain, is well known. It may, therefore, be of interest to hear of the end of the Caucasus herd, the last pure-blooded wisents living in a wild state. When the Kuban (Caucasus) Wisent Reserve (1100 square miles) was created by the Soviet government in 1924, the number of wisents indigenous to the region and living in the Caucasus Mountains was twenty-five, the last remnant of the great herd living there during the former regime and which consisted of some 1000 in 1911. It proved, however, impossible at the time of the founding of the reserve and

also in 1925, when a commission visited it, to get sight of the wisents. In order to clear up the situation the Head Administration of the Scientific Institutes of Moscow organized a small expedition in the summer of 1927. The leader was the well known Doctor Filatow, and his aide, M. P. Rosanow, former director of a wisent reserve founded in the Crimea in 1914 and destroyed during the Civil War. Besides these, was one Daniel Siedun, a former guard of the Bialowics Reserve. The writer was unable to accompany the expedition and the following facts are taken from an address, made by Rosanow on December 27, 1927, at a meeting of the State Commission for Nature Protection, in Moscow.

In the beginning of August, 1927, the members of the expedition met in Maikop, where the Kuban Reserve administration is located, and began their fatiguing journey through the mountains, chiefly on foot. All the valleys, where wisents were known to have lived in 1911, when Filatow made a journey of investigation in the region, were explored, and by the beginning of October the explorers returned with fine general results, but not a single living wisent had been seen. Plenty of traces were found, such as trees gnawed in the manner characteristic of the wisent, bones (chiefly horns and skulls, the other remains having been disposed of by the numerous bears in the region), and some skulls showing bullet wounds. The condition of all the bones pointed to a period of two or three years at most since the death of the subjects. Thus the remaining Caucasus wisents have all been recently killed, in the beginning perhaps by participants in the Civil War, and later by poachers and settlers who disregarded the laws. Under the well known condition of affairs in Russia, it is not surprising that the superintendence over a region of 1100 square miles was not overly thorough. There may still possibly be one or two wisents in remote haunts, but they can no longer represent a positive factor toward preservation of the species, which must remain in the small groups of animals scattered over Europe.

The season of the year is now at hand when the less tranquil slumbers of the corresponding secretary are often seriously disturbed by horrid apparitions of an allegorical company composed of delinquent dues and resignations from membership, which threaten to overtake and annihilate by mayhem and other revolting practices a second company of bright-faced, smiling individuals labelled "new members." We all trust that this will prove to be merely a touch of indigestion, but it is likely that the corresponding secretary will be thankful for having his mind set entirely at rest by heavy reënforcements to the ranks of new members.

The attempts recently made to stock the Upper Mississippi River Wild Life and Fish Refuge with beaver colonies are beginning to show good results. The superintendent of the refuge, in a recent report to the U. S. Biological Survey, which administers the reservation, states that the beavers captured in northern Wisconsin last spring and liberated on the flats near Wabasha, Minnesota, are apparently doing well. Reservation rangers recently discovered two new lodges constructed by the animals on a small slough near the place they were liberated. After seeing these, the superintendent stated that from the quantity of winter food collected by the beavers and submerged in front of the new lodges, and from the extent the animals have cut the aspen and willow growth along the slough, there has been some increase from the pairs liberated. The fact that the

beavers are remaining and building their lodges in the bottomland instead of following up some of the streams coming in from the hills indicates that the bottomlands are adapted to beaver colonization. The superintendent considers it desirable to stock the bottomlands with beavers at various points along the three-hundred miles over which the refuge extends.

According to reports of the U. S. Forest Service deer are growing so numerous on some of the national forests that there is danger of their starvation. The annual game census of the service indicates that the number of deer on the forests is almost everywhere increasing. This is in spite of the fact that except on certain areas set aside as game refuges the only restriction upon hunting are those imposed by state game laws. The Forest Service holds that the logical remedy is the development of game management plans. The basic principle of these plans is to establish and maintain a balance between the number of animals and their yearlong food supply.

In a state of nature such a balance is automatically maintained, admit the forest officers, largely through the check imposed by wolves, mountain lions, lynxes, and other animals that prey on the game. But man has greatly reduced the number of such killers. This leaves as the chief natural check the factors of famine and disease.

A given land area under given conditions, it is pointed out, can grow only a certain quantity of game feed. The quantity available varies with the season. Thus when an excessive number of animals are seeking sustenance a short forage crop or an extra hard winter results in undernutrition, increased susceptibility to disease, and a struggle for life under which the weaker animals often succumb in large numbers.

At the present time the most acute situation on any national forest is on the Kaibab, in northern Arizona. The deer herd on this forest, containing more than 28,000 head, has outrun the food supply so far that fawns born the previous year have died, and many of the other animals as well. The Forest Service declares that acquiescence in this condition is both uneconomic and inhuman. The Forest Service also claims that a somewhat similar situation threatens the elk herds of the Yellowstone region.

Under a game management plan the aim would be to prevent overcrowding by finding out how many deer or elk the available land will carry permanently, and varying the amount of hunting permitted so that the herds of game will be kept at this number. Stable in place of fluctuating herds would mean a constant stock of breeding animals, would permit of utilizing the increase for food, and would prevent the decline in the productive capacity of the land which overgrazing—whether by domestic livestock or game herds—inevitably produces.

Rigid state game laws which make impossible the application of a flexible system may, however, create great difficulties for any rational management plan. This has been true in the case of the Kaibab deer. To the extent that wild life has a place in forest administration the Forest Service seeks to work in coöperation with the states for the development of the most favorable conditions.

An excessive number of deer not only means that they are subjected to undernutrition and are in danger of being killed off wholesale by starvation and disease but also, the forest officers claim results in serious injury to tree-growth, since

the hungry deer are forced to browse on anything they can reach, and thus destroy the forest reproduction. While deer normally subsist largely on browse, if the herds are kept within reasonable limits they can obtain an adequate food supply without curtailing the growth of the forest. As a first step toward introducing sound game management plans the Forest Service is studying the conditions on the ground, locality by locality, in order to determine in each case what the limit should be.

Comment on the above from the Forest Service is scarcely necessary. The premises are as presented. It is worthy of remark, however, that forest officers admit that man, through his check imposed on predatory mammals, is largely responsible for the serious injury to tree-growth caused by over-browsing.

William P. Rauch, Jr., of 15 East 48th Street, New York City, died suddenly in Victoria, British Columbia, on May 17, 1928. Mr. Rauch was a keen observer of wild life and was deeply interested in natural history, particularly in the fauna of Alaska.

T. A. English, of Berkeley, California, passed away on July 25, 1928.

Colonel Wirt Robinson, a naturalist interested in many fields, died January 20, 1929, at his home in Washington, D. C. Colonel Robinson was born in Buckingham County, Virginia, October 16, 1864. He studied at Richmond College, and was graduated from the United States Military Academy at West Point, New York, in 1887. He served for several years in the artillery, taught military science at Harvard University from 1894 to 1898, and during recent years has been head of the department of chemistry at West Point until his retirement last October. He was an active collector of mammals when opportunity offered itself. During the summer of 1900, he spent six weeks in company with Dr. Marcus Ward Lyon, Jr., collecting zoölogical material in the vicinity of La Guira, Venezuela, as a result of which two new species, *Oryzomys medius* and *Lophostoma venezuelae*, were described, and thirty-three forms of mammals listed, in a paper published jointly by Robinson and Lyon (An Annotated List of the Mammals of La Guira, Venezuela, Proc. U. S. Nat. Mus., vol. 24, pp. 135–162, October 3, 1901). Colonel Robinson was also author of the book "A Flying Trip to the Tropics," published in 1896.